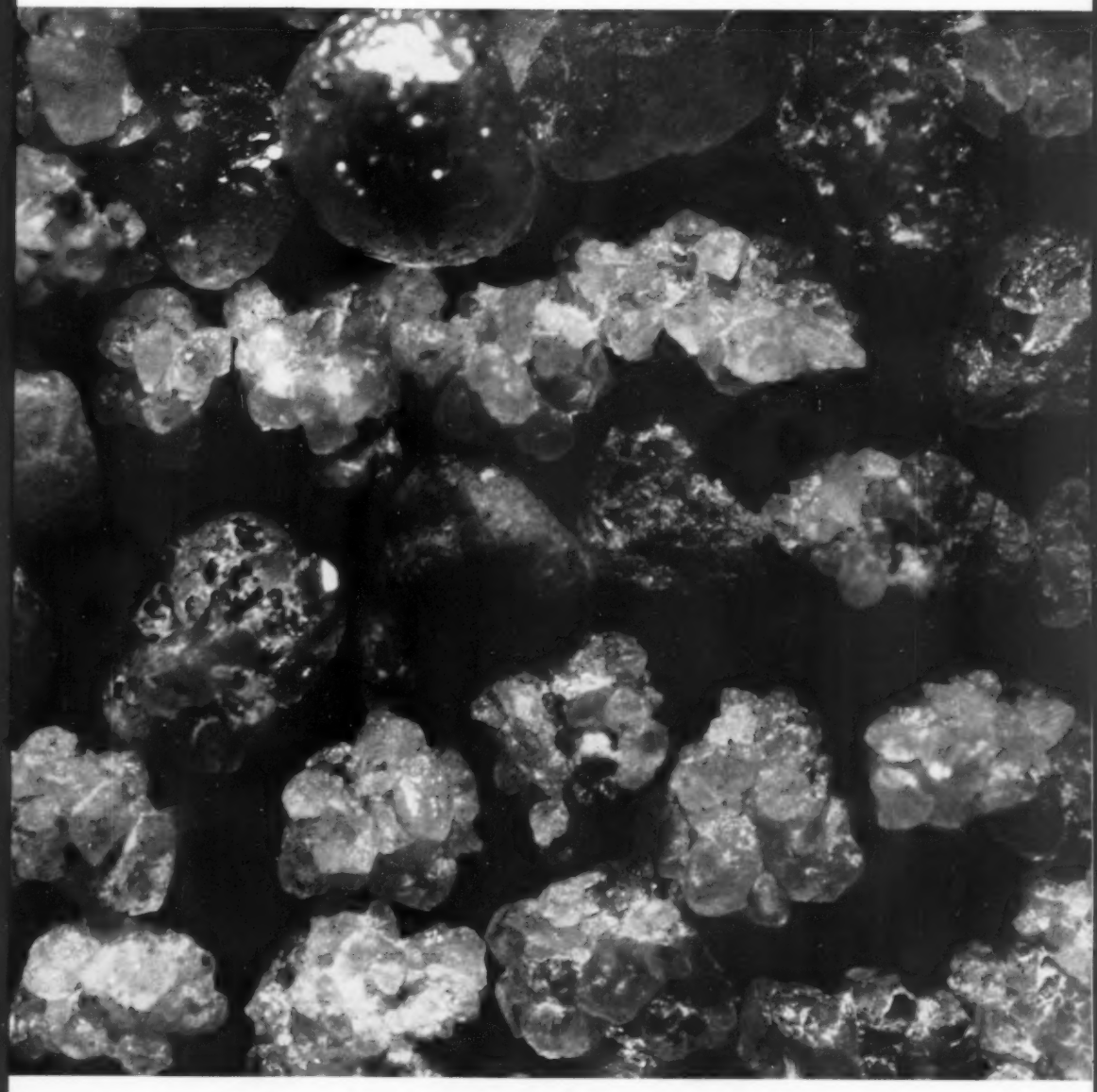
SAND SYMPOSIUM

Page 60

OCTOBER
1961

FOUNDRY

A PENTON PUBLICATION



CONTENTS—Pages 3-4

FIVE-DEEP

Unmatched facilities nearby

help you profit with UCM's "FIVE-DEEP" Ferroalloys

1 Unmatched Facilities for production and fast delivery of Union Carbide Metals' FIVE-DEEP alloys insure uninterrupted production at your metal-producing plant!

Six plants—3 with their own power facilities—and 17 warehouses, all located for fast shipments by rail, truck, or water.

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4 Global Ore Sources assure you uninterrupted supplies of ferroalloys. UCM's close association with world-wide mines provides dependable raw material sources.

5 Customer Service brings you our integrated experience in the application of ferroalloys to various melting practices. Engineers from 9 UCM field offices travel a million miles a year to provide on-the-scene assistance.

For better metals, production economies, bigger profits, insist on UCM's FIVE-DEEP alloys. Union Carbide Metals Company, Division of Union Carbide Corporation, 270 Park Avenue, New York 17, N. Y., producer of "Electromet" brand metallurgical products.

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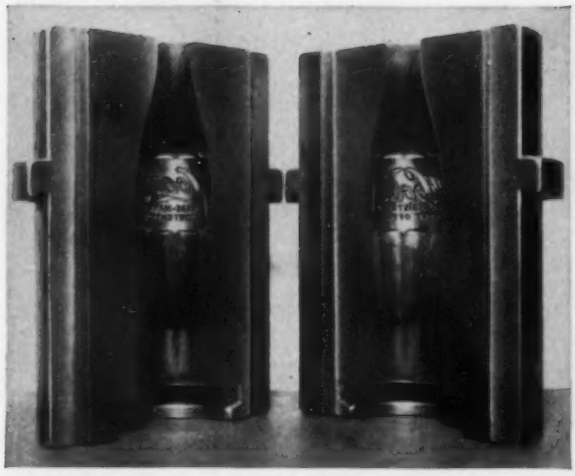
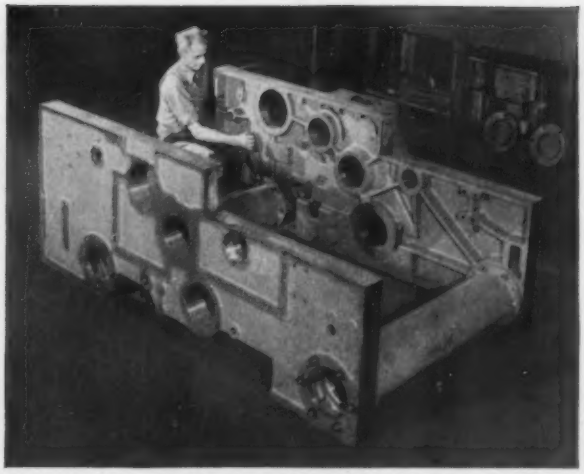
UNION CARBIDE METALS

For More Information Circle 551, Page 39

Only **ELECTROMET** ferroalloys from **UCM** are so deep in extra values to help you.

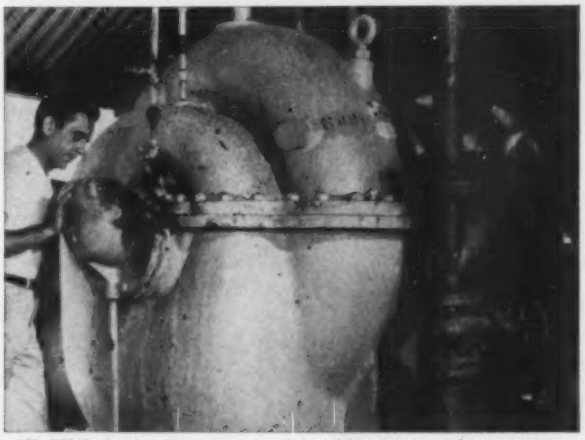


This 1% Nickel cast iron mold has a dense, close-grained structure that assures highest-quality bottles and long service life.



Large, intricate castings made of 2½% Nickel cast iron have superior dimensional stability through light and heavy sections.

What every foundryman and user of castings should know about Nickel cast irons



2% Nickel cast iron was used in this pump casing to assure pressure-tightness and resistance to corrosion, erosion and wear.

Here are important facts about the combinations of properties available in Nickel cast irons . . .

1. Tensile and compressive strength

Nickel increases tensile strength, toughens and strengthens the matrix, and has a refining effect on the graphite in gray iron castings.

2. Wear resistance

Nickel cast irons have fine, uniform pearlite, and ideal graphite size and distribution that greatly improves wear resistance in castings.

3. Properties in varying section sizes

Nickel cast irons have ideal matrix structure and graphite distribution that tends to suppress chilling and promotes uniform properties throughout the casting. In unalloyed gray iron castings, hardness and strength are influenced by section size, because graphite flake size and matrix structure are dependent on cooling rates in castings.

4. Machinability over wide range of hardness

Nickel cast irons are *free* of hard carbides — have good graphite distribution and uniform matrix structure that promote best machinability at any given tensile strength.

5. Rigidity

Nickel cast irons have a higher modulus of elasticity than unalloyed gray irons, in conjunction with other enhanced properties.

6. Notch sensitivity and vibration damping capacity

Nickel cast irons have refined, uniformly-distributed graphite flake patterns that permit optimum damping capacity at any given tensile strength.

7. Resistance to thermal shock and general heat effects

From room temperature to approximately 650°F, Nickel cast irons withstand loads of approximately 80% of tensile strength for indefinite periods. And at temperatures to 1300°F, Nickel cast irons maintain a higher proportion of strength and hardness with less growth and scaling.

8. Response to heat treatment

Balanced alloy compositions of Nickel cast irons respond uniformly to hardening processes. Nickel lowers the critical temperature range of iron castings — assures a deeper, more uniform hardness with milder quenches that minimize cracking and distortion.

Superior combinations of properties

Superior *combinations* of useful engineering properties are possible with Nickel cast irons — including ready machinability, pressure-tightness and uniform properties in light and heavy sections. For engineering data on Nickel cast irons for specific applications, write to:

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MAKES CASTINGS PERFORM BETTER LONGER

For More Information Circle 554, Page 39

Dimensional stability in intricate cores is achieved by Hills-McCanna, Chicago, through use of CB-40

Now a report from Hills-McCanna Company:

Good-rite CB-40 decreases blows, makes core baking far less critical

More on the new low-gassing mold and core binder, this time from Hills-McCanna Company, Chicago.

Low-gassing. Hills-McCanna reports a "decreased tendency for blows in small internal cores." This is a company that should know, since the intricate castings it makes for the aircraft industry have very complex coring. At the same time, Good-rite CB-40 provides excellent dimensional stability in the core, resulting in far closer tolerance in casting.

Easier baking. "Without decreasing core quality, we can use lower baking temperatures—and can operate without the concern for exact temperature created by other types of binder." Hills-McCanna also says that collapsibility is excellent.

Other advantages: At this foundry, bench life of Good-rite CB-40 has proved excellent. It can be used by any present method—is safe at all stages, will not burn, releases no objectionable fumes.

You can learn more: Write for complete information on Good-rite CB-40 to Department PD-5, B.F.Goodrich Chemical Company, 3135 Euclid Ave., Cleveland 15, O. In Canada: Kitchener, Ont.

Good-rite CHEMICALS

B.F.Goodrich Chemical Company

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For More Information Circle 555, Page 39

October 1961
Volume 89—Number 10

FOUNDRY
A PENTON PUBLICATION

The cover photo, showing Portage core sand at 60 magnification, is reproduced through the courtesy of G. B. Greenwood and H. E. Witt, the Buckeye Steel Castings Co., Columbus, Ohio. The New Jersey sand above is shown at 30X

Try To Be Around! 59
Editorial—By WILLIAM G. GUDE

Sand Symposium 60
This special presentation consists of five papers presented as a sand symposium early this year by Northeastern Ohio Chapter of the American Foundrymen's Society. They deal with properties and applications of sands and binders, mixing techniques, and testing and evaluation of materials

Factors Influencing Molding Sand Properties 61
Behavior of molding sands in the green and dry states and in high-temperature environments can be explained and predicted from data based on properties of clay-water systems, packing of aggregates, and the effect of heat on those two components—By Dr. WILLIS G. LAWRENCE

Mixing and Molding Green Sands 68
A number of changes in green molding sand occur during its mixing. This article describes those changes and their effects on the behavior of molding sand during squeeze and jolt molding—By Prof. RICHARD W. HEINE

Be Your Own Sand Detective 76
Sand control must be capable of predetermining its effect on ultimate casting quality. This article presents a method of green sand evaluation that can be used daily in the foundry—By JOSEPH S. SCHUMACHER

How Materials Affect Oil-Bonded and Shell Cores 82
Core sand is a complicated mixture. Varying amounts of additives affect its properties, and individual additives vary in their characteristics. Even sand grain size alters effects of additives—By EDWARD C. ZUPPANN

How To Use CO_2 Process and Furan Cores 88
Foundrymen should avoid becoming process or product oriented. Production of a new job should be considered from the standpoint of the best, cheapest way to make a salable casting—By ROBERT J. MULLIGAN

The World of Cast Metals 23
AFS Approves Plans for T & RI Building 23
1962 Kennedy Memorial Apprentice Contest Opens 23
Bread Program at Ohio Foundry Conference 26
Foundry Sessions Set for Magnesium Meeting 26
Gray Iron Founders Open New Safety Contest 30
Ford Cleveland Foundry Sets Industry Safety Record . . . 30

Man to Man 114
Sometimes foundrymen are inclined to be so wrapped up in the mechanics of a job that they lose sight of the humanics—By RALPH L. LEE

Gating Permanent Mold Gray Iron Castings . . 120
Gating of permanent molded gray iron generally follows the principles used for other metals with the limitations of gate location at the parting line. Risering requirements are minor—By HOWARD U. McCLELLAND

CONTINUED NEXT PAGE

Editor: WILLIAM G. GUDE

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CONTINUED FROM PAGE 3

Making Difficult Diecastings 134
Western Die Casting Co. produces diecastings with no draft, with 0.010-in. wall sections, and 0.0005-in. tolerances—By HOWARD E. JACKSON

Foundry Carbide Produces Hot, Fluid Iron . . . 141
A special calcium carbide raises iron temperatures in the cupola, aids carbon absorption, increases melting rate, and lowers sulfur in iron

Marketing—Key to Profitable Operations . . . 148
Profitable operation depends on finding out what your customers want, then satisfying those wants—By LOUIS IANNETTONI and JAMES J. BLAHA

Diecast Block Production Is Highly Mechanized 165
Chrysler Corp. plans to produce 60,000 diecast aluminum blocks for 1962 Valiants and Lancers. Mechanization is featured—By ROBERT H. HERRMANN

Cuts Costs with Shell Coremaking 182
At Crouse-Hinds Co., Syracuse, N. Y., one man makes up to 7000 cores in a 7½-hr work day at up to 50 per cent lower costs—By C. H. ALVORD

Program Tells about Castings and Foundries . . 187
Twin City Chapter, AFS, has developed an effective program to familiarize students with foundry principles and opportunities—By MATT GRANLUND

New Design Combines Weldment and Castings 198
Cast-weld design of riveting machines facilitates construction, cuts costs, and improves delivery on custom orders

International Foundry Congress Reports 201
By M. M. HALLETT

In Every Issue

Around the Country 175
Calendar of Meetings 32
Equipment and Supplies . . . 101
Foundry Developments . . . 138
How To Do It 132
Industry Briefs 129
Late News 17
Literature for Foundrymen . 155
Men of Industry 213
Obituary 210
Patents of Interest 190
Questions and Answers . . . 94
Statistics 17
The Shakeout 222
With the Editors 10

Classified Advertising—229 **Advertising Index—241** **Business Staff—241**

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THE EDITORS' WORKSHOP

CENTRIFUGAL CASTING: To bring you up to date on centrifugal casting practice for ferrous metals, we plan to present a comprehensive report shortly. Written by Thomas Watmough and John T. Berry, Armour Research Foundation of Illinois Institute of Technology, the article will discuss the various types of equipment and metallurgical considerations involved in the process. An up-to-date review of the literature on the subject also is included.

GRAY IRON: "Solidification, Structure, and Properties of Gray Iron" is the title of a coming article that will be of interest to gray iron founders. It is a review of the most recent U. S., British, and Russian literature on the subject, and was prepared with a view of presenting various aspects of nucleation and growth in simple terms. Author is Harish D. Merchant, research metallurgist, Owens-Illinois Technical Center, Toledo, Ohio.

NEW MARKET: Concrete highways wouldn't seem to offer much of a market for castings. One foundry, however, has developed a fairly sizable outlet for malleable iron castings through development of an improved transverse joint that is finding growing application in road building. Watch for details next month.

MEETINGS: The annual fall deluge of foundry meetings has started. By the end of this month FOUNDRY editors will have covered 12 annual meetings and regional conferences. High lights of the gatherings will be reported in the November and December issues.

SURFACE FINISH: Why has the establishment of standards for surface finish of castings been neglected? See the November issue for an interesting discussion of the problems involved and one possible solution. It's by Einar A. Borch and David E. Neustadt, National Metal Abrasives Co.

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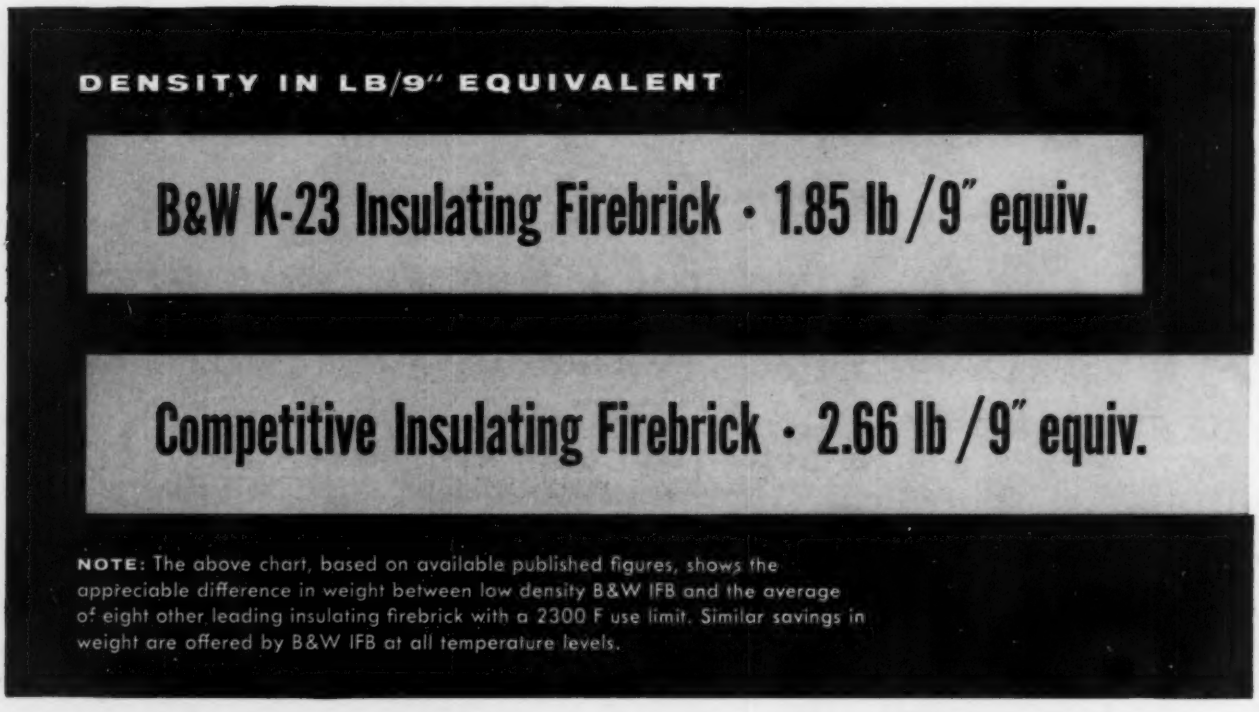
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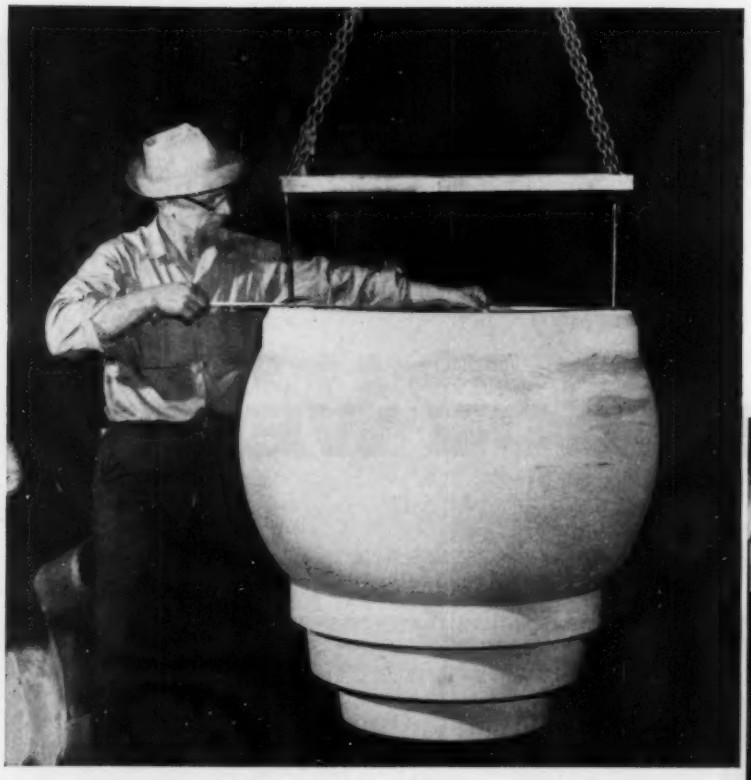
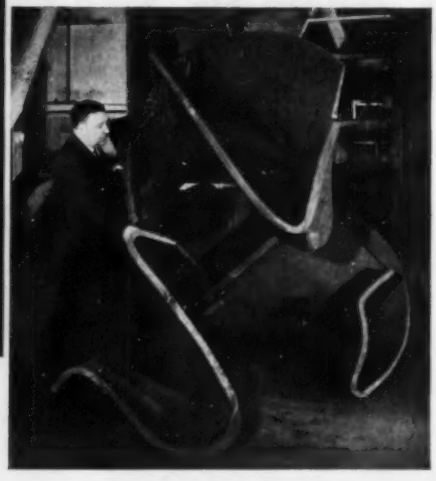


1100-pound core for ball casting made at Olympic Steel Works in just 20 minutes, using Liquid Carbonic's bakeless hardening process. Conventional methods would have taken 12 hours.

E. A. Slater, Liquid Carbonic Sales Representative, inspects a Navy destroyer's massive hawse pipe at Olympic. The CO_2 process reduced production costs on this unit by one-third.



HOW

OLYMPIC STEEL WORKS

OBTAINS NEW BUSINESS WITH CO_2 PROCESS

The Olympic Steel Works in Seattle had a problem. They had an order to produce hundreds of giant ball and socket castings, but had to meet a tight delivery deadline and reduce costs in meeting it. Not being a company to say something can't be done, Olympic accomplished both objectives, and other benefits, by using the Liquid Carbonic CO_2 core-hardening process.

New process saved over 11 hours in curing big cores

Previously, 1100-pound cores required 12 hours of curing. With Liquid Carbonic's bakeless CO_2 process, they were ready for the molds in just 20 minutes. The 700-pound cores took only 7 minutes (previously: 8 hours) and 6-pound cores, formerly requiring 2 hours, only 30 seconds. Needless to say, Olympic delivered ahead of schedule.

New business for new CO_2 process

This experience prompted the company to also use the CO_2 process to produce intricately shaped deck edge hawse pipe for Navy destroyers. No longer were dry sand casting cores required. And simplified patterns reduced production cost one-third. Of course, the castings were also produced faster and more accurately.

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For More Information Circle 560, Page 39

With the EDITORS

HOW ARE YOUR PRICES?: The steel industry has been undergoing unwarranted attacks by a few members of Congress, administration economists and even the President in the matter of price increases. Governed by political motives rather than sound economic facts, these leaders of government are trying to build public opinion against price increases as a control of inflation while permitting labor to continue its demands without any suggestion of the part this plays in furthering inflation.

It hardly behooves the Congress and the administration who have embarked on a spending spree of public funds that cannot help but lead to inflation, to try to pin the blame on industry.

Industry should be entitled to a fair profit. If your operation is efficient and your prices do not produce such a profit, now is the time to get them in line.

Just Slang: I recently received an unsigned letter which asked "Is your vocabulary so limited and restricted that in order to express yourself it is necessary to resort to language of the gutter?" There were several other caustic comments directed toward my editorial in the August, 1961 issue which was headed "Let's Quit Bitching."

Am sorry that the gentleman did not think enough of his criticisms to sign his name to the letter. I would have liked to explain to him that changes constantly are taking place in our language, and that words that at one time may be in disrepute can become acceptable over a period of time.

Take the word "bitching," for example. Earlier dictionaries did indicate that it was vulgar, but the armed forces in World War II and the Korean War brought some respectability to the term. The latest dictionary shows that "bitching" is a slang term, but any reference to vulgarity has been dropped.

Sorry to have offended anyone. Judging from the many favorable comments received, however, the heading did attract many readers. That's why we used it.

How Safe: The safety record over the Labor Day holiday showed improvement. It may be that the campaign of the trucking industry to have headlights on in the day time was helpful. I was on the road briefly on several occasions over the week-end, and found many cars, trucks, and busses with lights on.

But there seemed to be something terribly out of place to see a large truck bowling around curves at excessive speeds with lights on to remind others to drive safely. I witnessed this on two occasions.

Perhaps the crowning touch was illustrated in an AP dispatch which said in part:

"Trooper Ivan Finch halted David L. Warnaar of Harvey, Ill., on U. S. 41 north of here (Kentland, Ind.) Sunday and listened as Warnaar explained he had his car lights on also in connection with the safety drive.

"That wasn't quite the problem, as Finch explained. A police airplane overhead had just clocked the 'safe' motorist at 93 miles an hour.

"Warnaar was fined a total of $22.75 in justice of peace court here and was jailed pending payment."

Murder Story: *Steel's* associate managing editor, John Morgan, had a thought - provoking editorial in a recent issue that is just too good to miss. So we reproduce it:

Charles Butler & Co. is an old-line fabricator, founded in 1894 by the present president's grandfather. Its plant is a picturesque edifice of the Victorian era. The factory grounds are beautifully maintained. Inside, the housekeeping is immaculate, and much of the machinery is of historical interest.

Charles Butler III, now president, is proud that he kept the union out for so many years. "I am just your custodian here," was his oft-repeated message to employees. "Call me the butler."

He attributes the union's recent certification victory partly to the fact that the Internal Revenue Service disallowed the

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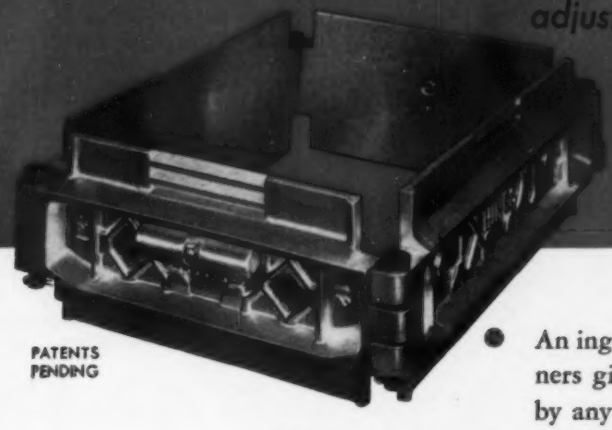

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For More Information Circle 561, Page 39

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4 TYPES

Feedex®

A moldable exothermic—generally used as a sleeve or cylinder—used to line risers in sand and ingot molds.

Feedol

An exothermic hot-topping compound for heating and insulating the surface of risers in all non-ferrous castings.

Ferrux

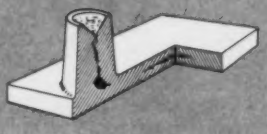
A heat producing compound for insulating and heating the risers of iron and steel castings.

Kalmex®

This Foseco exothermic—used for steel and iron castings—produces liquid metal which serves to increase the amount of available feed metal in the head. It produces high heat and provides an insulating slag.

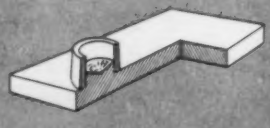
Foseco Technical Service—
available to help you solve foundry problems.

Foseco® Exothermics Insure Feeding Efficiency



INADEQUATE RISER
Without an exothermic, metal in inadequate conventional risers solidifies before filling cavity.

CONVENTIONAL RISER
With adequate conventional riser, feeding is satisfactory but increased size of riser requires excessive cleaning, wastes feed metal.



EXOTHERMIC RISER
Foseco exothermic riser is only one-fourth the volume of adequate conventional riser above. Metal stays molten in riser, feeds by atmospheric pressure, assuring sound castings with no piping or shrinkage.

Foseco®

FOSECO, INC.
P. O. Box 8728 • Cleveland 35, Ohio
Phone: BEres 4-3551

A world-wide organization serving the chemical and metallurgical needs of the entire metal casting industry.

company's yacht as a legitimate business expense on the 1958 return. He, of course, had to give up the vessel, along with the July 4 and Labor Day cruises for workers and their families. As a result, they became disgruntled.

Since the three-month strike last year, things seemed to be shaping up a little better with the union. But a wildcat in May gave an important contract to a competitor.

Although Butler & Co., had all the work it could handle last year, it lost money. Price fighting was rampant. Charles Butler had to take over himself as sales manager after his wife's brother let the price situation get out of hand. Lately, foreign competition has been increasingly troublesome.

Since Ed Johnson died four years ago, Mr. Butler has had trouble finding a good chief engineer. All the bright youngsters want to work in Arizona with electronic companies. Al Hart perhaps isn't as spry as a production superintendent should be, but you can't beat nearly 50 years' experience.

A drastic cost cutting program since the first of the year seemed to be helping. The sales promotion budget was cut to almost nothing. The purchase of welding equipment was delayed to 1962. Mr. Butler slashed pay of all salaried employees 15 per cent and tightened up on expense accounts.

Yet none of those steps really helped. Charles Butler & Co. filed for bankruptcy today.

Who was the murderer? The government? The union? Foreign competition?

No, the butler did it.

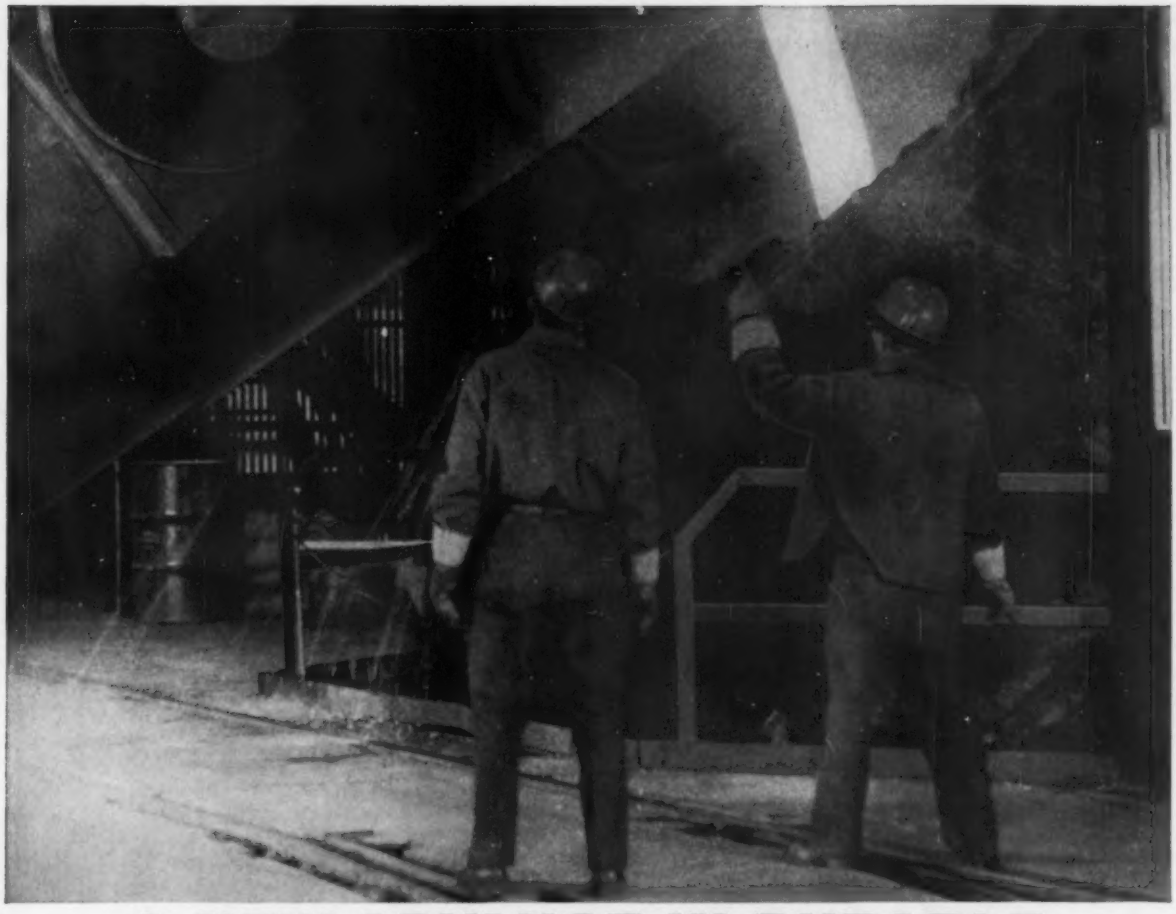
Eliminate Waste: I noticed the following paragraph in the weekly bulletin which one of our most progressive foundries sends to its employees:

"If we can improve our cost we can make our jobs more secure. However, to have better costs we need to prevent waste—waste of time—waste of material—waste of equipment. Keeping cost down keeps our company competitive, and that should mean better business and better working schedules for us all.

Everyone who is on the payroll can help by preventing waste on the job. All of us hate to come in second at anything so have a grand vacation and come back refreshed to pitch in to better our quality, better our service, and to reduce our cost."

Are you telling your people about the need for eliminating waste in your plant?

F.G.S



A NEW ADVANCE IN DURABLE FLAME RETARDANT WORK CLOTHES

It takes the optimum combination of fiber, fabric, and finish to make the best possible fire retardant work clothing . . . and this combination has been achieved in a new *Mount Vernon Safety Fabric.*

The fiber is cotton – the world's most comfortable fiber: cool, absorbent . . . with no static electricity and no melting at high temperatures.

The cloth is a MOUNT VERNON fabric specifically developed for this use. It is designed for high strength, resistance to tearing and abrasion, and maximum air porosity . . . and to retain these properties throughout the life of the garment.

The finish is Lynrus FR-1*. It chemically combines with the fiber and the cloth to produce *Mount Vernon Safety Fabric.*

Mount Vernon
SAFETY
FABRIC

LYNRUS F.R.1*
Durable Flame Retardant Finish

It provides durable flame resistance that will last for the life of the fabric whether it is laundered or drycleaned. *Mount Vernon Safety Fabric* will not support flame. Afterglow in charred areas is negligible.

Mount Vernon Safety Fabric is mildew resistant, wrinkle resistant, and has bacteriostatic properties which tend to inhibit perspiration odor development. It is non-allergenic, non-irritating, and non-toxic. Because the fabric is soft and flexible, without a trace of stiffness or harshness, it can be styled into smart, comfortable work clothes.

These claims are supported by scientific tests; use the coupon to write for your copy of "Technical Facts About *Mount Vernon Safety Fabric.*"

Mount Vernon Mills, inc.
A LEADER IN INDUSTRIAL TEXTILES

TURNER HALSEY COMPANY
SELLING AGENTS

Main Office and Foreign Division: 40 Worth Street, New York, N. Y.
Branch Offices: Chicago • Atlanta • Baltimore • Boston • Los Angeles

*Trademark of Lynrus Finishing Company, Inc., Poughkeepsie, New York

TURNER HALSEY COMPANY, Dept. F-1
40 Worth Street, New York 13, N. Y.

I am interested in knowing more about MOUNT VERNON SAFETY FABRIC. Please send me:

☐ a copy of "Technical Facts About MOUNT VERNON SAFETY FABRIC."

☐ a swatch of MOUNT VERNON SAFETY FABRIC, so I can test it myself.

Name_____

Company_____

Address_____

City_____ Zone____ State_____

3 reasons why our industry has accepted Multi-Mull

1. QUALITY OF PREPARED SAND

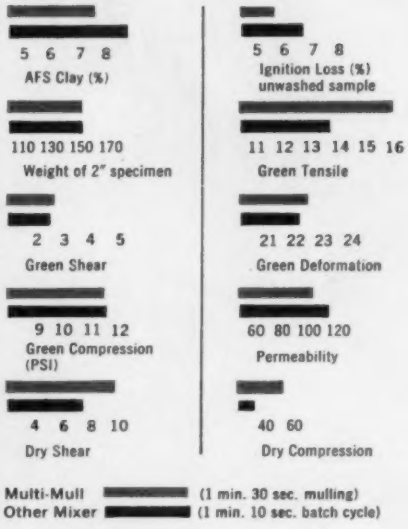
Test show Multi-Mull superiority

In a series of actual foundry tests (right), system sands from a Multi-Mull and another mixer are compared. The same base sands from the same foundry using the same bond slurry are the everyday product of entirely dissimilar mullers. Mulling times are shown.

The knowing sand technician sees here that which the practical man knows by "hand feel" — the Multi-Mull sand will lift better; will wash, cut and buckle less. There is more to sand quality than simple compression tests show.

The superiority of Multi-Mull sand is attributed to two factors:

1. The unique recirculation feature within the muller.
2. The sound mulling principle inherent to *all* Simpson mullers.



2. QUANTITY OF PREPARED SAND

It's continuous — all preparing time is used for mulling

In the Multi-Mull, time spent on weighing, batching, charging, wetting-out and discharge is eliminated . . . as is "pre-mull", dispersion and tempering of bonds. All time in the muller is spent in developing desired properties in the sand being mulled.

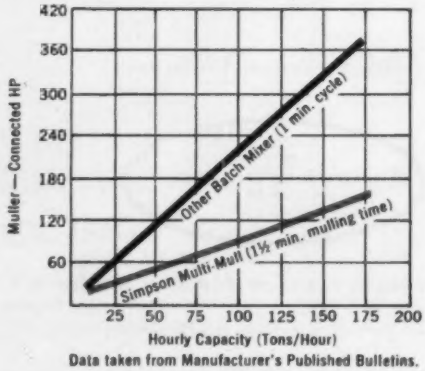
Time saved here contributes to Multi-Mull's proven ability to produce sand at the highest productive rate per dollar of investment in Mulling Equipment.

3. ECONOMY OF OPERATION

Multi-Mull can reduce the cost of sand preparing Installations

Lower cost per ton per hour of capacity is only one of the important savings you can expect with Multi-Mull. Continuous mulling also eliminates batching equipment and the costly maze of multiple bins, controls and separate sand handling devices which must serve batch mixer installations. Less time and manpower is required to operate and maintain a Multi-Mull installation.

Consider: *Connected Horsepower* per ton, per hour of capacity. Examine the graph at right. Then ask your own engineers what a Multi-Mull system could save you in power supply and control costs alone.



Data taken from Manufacturer's Published Bulletins.

MULTI-MULL ORDERS NOW EXCEED
14,000,000 TONS PER YEAR OF CAPACITY

After 3½ years of testing and development, the Simpson Multi-Mull was formally introduced to our industry at the 1960 Foundry Show. Now, only a year later, over 14 million tons of annual capacity in this new continuous muller has been sold.

Why has Multi-Mull gained this wide and immediate acceptance by the country's most technically advanced foundries? There are three reasons. They add up to one fact which is significant to *all* foundrymen:

The Simpson Multi-Mull was developed for one purpose—to provide foundrymen with mulling equipment capable of *more economically* producing the *consistently* high quality sand required by advancing foundry technology. For this reason . . .

Foundrymen who are competitively waging the battle of profit vs. cost are "tooling up" with Simpson Multi-Mull.

Write for literature.

NATIONAL ENGINEERING COMPANY
646 Machinery Hall Building • Chicago 6, Illinois

F-961-S

For More Information Circle 564, Page 39

here's a pilot you can trust!

In hundreds of thousands of heavy-duty industrial air valve applications, Valvair pilots have proved their ability to provide trouble-free performance and multi-million cycle dependability. They offer maximum simplicity, with but two moving parts . . . flow-through cooling, with air passing through the center of the pilot for heat dissipation during rapid cycling . . . low current draw to prevent overheating, even when continuously energized for hours, days or weeks! And, Valvair pilot coils are potted in resin for moisture-resistance . . . are guaranteed against burn-out for the life of the valve.

What's more, Valvair's pilot is truly universal . . . interchangeable for use on any Speed King® valve. There's no need to stock a confusing quantity of different pilot assemblies or a myriad of parts. So, stockroom and in-service maintenance problems are minimized.

Pilot performance is vital to the dependable operation of the machinery you design, build or use. Your nearby Bellows-Valvair Field Engineer can show you why Valvair's pilot is the one you can trust.

For more information, write for Bulletin FL-61. Address Bellows-Valvair, Akron 9, Ohio, Dept. FO-1061.

8192

Bellows-Valvair
AKRON 9, OHIO
DIVISION OF INTERNATIONAL BASIC ECONOMY CORPORATION (IBEC)

LATE NEWS

BROKEN RECORD: Analyses of foundry industry prospects are beginning to sound like a phonograph needle stuck in the same old groove. Specifically, business activity is continuing to rise, but foundry operations vary regionally or by type of production involved.

July, for example, marked a decline in casting shipments—largely because of widespread plant vacations—but output of durable goods hit a record high.

Every guidepost, however, points to increased casting production, in spite of the slowness of anticipated gains to materialize. The fourth quarter should be the year's best.

ALUMINUM PRICES CUT: Aluminum Co. of America has reduced domestic prices of aluminum ingot from 26 cents a pound to 24 cents, and Reynolds Metals has followed suit. At presstime, there had been no announcement of price changes in casting alloys. The table on p. 20 shows the previous prices.

SEE NONFERROUS GAINS: Non - Ferrous Founders' Society, at its annual meeting at Shawnee Inn, Shawnee-on-Delaware, Pa., Sept. 17-21, polled members on business conditions. Comparing sales of copper-base alloys for the first 8 months of 1960 and 1961, 33 per cent indicated sales were up, 33 per cent down, and 34 per cent the same. Comparing aluminum castings sales, 40 per cent reported them up, 30 per cent down, and 30 per cent unchanged. The poll showed 60 per cent expect copper-base sales to be up during the next six months, 10 per cent down, and 30 per

Foundry Statistics

Iron and Steel Scrap Consumption

(Gross tons*)

	All Scrap Total	By Types of Furnace — Cupola Total	Air Total	Electric Total
1959	58,979,881	9,613,059	1,156,097	9,232,037
1960				
May	5,037,658	771,800	79,170	652,605
5 mo.	30,789,638	4,011,220	461,816	4,483,202
June	4,485,444	809,297	87,485	633,797
July	3,678,127	603,062	55,974	520,361
Aug.	4,217,562	692,470	78,788	697,243
Sept.	4,148,550	732,252	76,939	641,712
Oct.	4,375,871	742,039	71,862	675,356
Nov.	3,939,979	709,187	70,282	607,471
Dec.	3,738,385	669,250	66,438	601,274
Total	59,387,010	8,968,777	989,584	8,850,396
1961				
Jan.	4,059,361	654,353	65,434	646,999
Feb.	3,925,802	593,810	61,286	642,853
Mar.	4,449,078	677,617	73,544	710,749
Apr.	4,665,842	675,271	70,073	725,994
May	5,333,515	757,033	82,093	837,312
5 mo.	22,433,598	3,358,084	352,430	3,463,907

Index of Foundry Equipment Orders

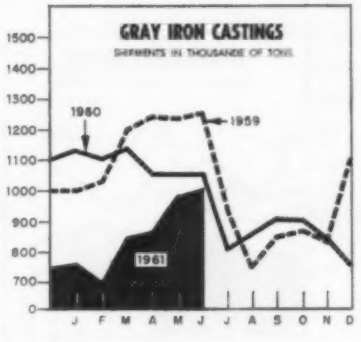
Foundry Trades Only

(Net Orders Closed, New Equipment)

	1960	1961
Jan.	95.5	123.7
Feb.	128.6	81.8
Mar.	159.9	99.1
Apr.	97.9	115.2
May	159.0	101.5
June	164.8	130.8
July	80.0	69.0
Aug.	92.4	....
Sept.	158.1	....
Oct.	81.7	....
Nov.	106.5	....
Dec.	101.2	....

Note: Base period 1947-49 taken as 100 per cent monthly average.

Source: Foundry Equipment Manufacturers Association.



GRAY IRON CASTINGS—SHIPMENTS

(Net tons[1])

	All Castings — Total	All Castings — For Sale	Miscellaneous Total	Castings For Sale Total	Nodular Iron Castings Total	Heavy Steel Ingot Molds Total	Chilled Railroad Car Wheels Total	Pressure Pipe & Fittings Total[2]	Soil Pipe & Fittings Total[2]	Unfilled Orders[3]
1959	12,307,798	6,994,200	7,451,925	3,247,389	173,433	2,142,498	309,945	1,440,883	862,547	.....
1960										
June	1,049,638	601,597	622,236	273,148	15,010	183,049	19,810	144,773	79,770	719,584
6 mo.	6,541,536	3,535,109	3,887,688	1,630,862	91,854	1,398,092	122,681	646,365	386,710	.....
July	803,306	450,580	478,269	202,347	10,694	120,784	16,226	120,652	67,375	754,789
Aug.	858,503	540,396	490,059	238,561	15,675	131,428	14,221	139,275	83,520	712,784
Sept.	900,497	527,227	554,788	245,887	14,616	125,688	13,460	135,327	71,234	695,325
Oct.	905,139	500,054	568,869	238,249	12,859	139,977	12,559	117,009	66,725	646,852
Nov.	835,709	454,611	538,817	230,022	11,870	123,054	12,410	102,959	58,469	568,974
Dec.	748,821	394,981	506,979	219,525	12,097	107,559	12,306	73,959	48,018	552,813
Totals	11,593,511	6,402,957	7,025,469	3,055,453	169,853[4]	2,246,582	203,863	1,335,546	782,051	.....
1961										
Jan.	760,136	406,315	504,182	222,508	11,874	123,277	11,847	89,881	50,949	599,778
Feb.	702,413	373,252	465,654	209,207	11,184	116,563	7,403	66,541	46,252	620,623
Mar.	856,491	496,928	509,932	232,384	12,193	155,545	9,090	110,792	71,132	651,096
Apr.	869,233	503,434	515,664	225,966	15,910	145,899	9,206	121,867	73,595	645,412
May	982,319	571,995	557,246	237,995	16,155	191,679	11,011	139,971	82,412	650,582
June	1,027,212	606,283	580,234	250,291	15,390	201,644	8,921	151,212	85,201	666,487
6 mo.	5,197,804	2,963,497	2,932,912	1,378,221	82,706	937,607	57,480	680,264	409,541	.....

Source: U. S. Dept. of Interior, Bureau of Mines. [1]Source: Bureau of the Census. [2]For sale only. [3]All cast iron pipe is shipped for sale. [4]Gray iron total includes nodular iron. [5]Monthly figures do not add up to total shown because of unreported monthly revisions.

cent unchanged. Forty per cent see aluminum castings sales improving during the next 6 months, 25 per cent see a reduction, and 35 per cent believe sales will be unchanged.

DIECASTERS OPTIMISTIC: The American Die Casting Institute, the national association of custom diecasters, predicts that 1961 diecasting production will be only slightly under 1960 levels and that 1962 will see a marked improvement. In '62, aluminum diecastings are expected to hit a record high level and zinc diecastings to approach the 350,000-ton rate normal for a year of high automotive output.

NFFS ELECTS: Non-Ferrous Founders' Society, at its annual meeting held Sept. 17-21 at Shawnee Inn, Shawnee-on-Delaware, Pa., elected the following officers: Dan A. Mitchell, Progressive Brass Mfg. Co., Tulsa, Okla., president; Lawrence J. Andres, Lawran Foundry Co., Milwaukee, first vice president; George W. Stewart, East Bay Brass Foundry, Richmond, Calif., second vice president; Herbert F. Scobie, reappointed executive secretary.

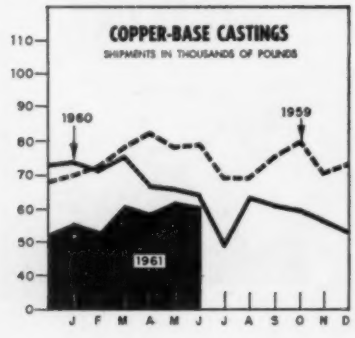
Walter M. Clark, B. W. Clark & Co. Inc., East Bridgewater, Mass., received the Non-Ferrous Founders' Society distinguished service award.

Cast Bronze Bearing Institute, a product group of NFFS, re-elected last year's officers. They include Carter N. Paden Jr., Moccasin Bushing Co., Chattanooga, Tenn., president; A. G. Eberle, Renewal Service Inc., Philadelphia, vice president; and Raymond O. Oyler, Bunting Brass & Bronze Co., Toledo, secretary-treasurer.

PISTON FOUNDRIES: Perfect Circle Corp. has started production at its new $3 million foundry at Rushville, Ind. It contains 90,000 sq ft of floor space and when in full two-shift operation is expected to employ about 175 persons . . . Sealed Power Corp., Muskegon, Mich., will spend about $1½ million to build and equip a piston ring casting and machining plant at Muskegon. The 50,000-sq-ft plant will employ 200 persons eventually and should be completed early next year.

FOUNDRY CLOSING: Westinghouse Electric Corp. will close its Trafford, Pa., foundry be-

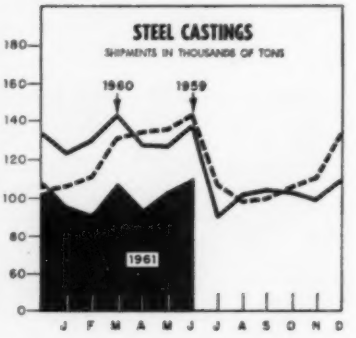
Foundry Statistics



COPPER-BASE CASTINGS

(Shipments of castings—1000 pounds[1])

	Shipments			Unfilled Orders[2]
	Total	Sand	Perm. Mold	
1959	871,032	765,246	52,456	.....
1960				
June	64,585	56,441	3,715	21,781
6 mo. ..	419,337	378,104	25,108	.....
July	48,399	42,778	2,910	22,367
Aug.	63,765	56,344	3,669	21,915
Sept.	61,362	54,104	3,699	21,063
Oct.	59,877	52,734	3,556	22,008
Nov.	56,358	50,043	3,132	21,261
Dec.	53,009	46,237	3,369	21,914
Total ...	762,107	670,344	45,443	.....
1961				
Jan.	55,578	48,928	3,286	22,792
Feb.	53,457	47,156	2,615	22,065
Mar.	61,252	53,277	3,414	20,965
Apr.	58,355	50,702	3,500	22,623
May	63,348	54,741	3,865	23,769
June	61,287	53,764	3,387	23,555
6 mo....	353,577	308,568	20,067	.....



STEEL CASTINGS—SHIPMENTS

(Net tons[1])

	All Castings			Carbon			Alloy			
	Total	For Sale	Railway Specialties	Total	For Sale	Railway Specialties	Total	For Sale	Railway Specialties	Unfilled Orders[2]
1959	1,412,885	1,112,668	210,984	1,043,538	814,219	194,201	369,347	308,449	16,783	.....
1960										
June	136,922	107,076	26,389	101,294	78,601	24,707	35,698	28,475	1,682	233,765
6 mo.	786,253	602,551	141,373	583,254	443,193	132,882	203,069	159,338	8,491	.....
July	89,565	67,294	13,430	63,753	47,570	12,804	25,812	19,724	626	223,880
Aug.	101,709	77,146	14,619	73,338	55,099	13,713	28,371	22,047	906	213,611
Sept.	104,298	79,556	14,171	74,447	56,126	13,273	29,851	23,430	898	199,413
Oct.	102,664	79,622	14,586	72,544	57,879	13,544	30,120	21,743	1,042	186,311
Nov.	99,577	78,305	15,768	69,927	56,466	14,113	29,650	21,839	1,655	174,317
Dec.	108,249	87,417	24,849	78,805	64,997	22,295	29,444	22,420	2,554	162,882
Totals	1,392,385	1,071,871	238,796	1,016,068	781,330	222,624	376,317	290,541	16,172	.....
1961										
Jan.	96,190	76,650	11,534	68,795	56,592	10,550	27,395	20,058	984	156,683
Feb.	92,602	71,907	9,128	64,849	51,209	7,818	27,753	20,698	1,310	145,024
Mar.	107,275	82,522	11,342	75,728	59,239	10,068	31,547	23,283	1,274	143,589
Apr.	93,978	71,027	5,414	65,844	49,763	4,381	28,134	21,264	1,033	147,234
May	103,205	79,485	8,966	73,860	57,246	7,950	29,345	22,239	1,016	157,354
June	109,110	84,477	11,499	76,700	60,183	9,970	32,410	24,294	1,529	151,385
6 mo.	602,360	466,068	57,883	425,776	334,232	50,737	176,584	131,836	7,146	.....

[1]Source: Bureau of the Census. [2]For sale only.

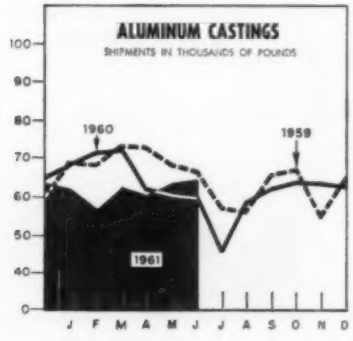
cause of a decline in volume due in part to technological changes. Operations will be reduced progressively in the next six months.

ADCI ELECTS: New officers of the American Die Casting Institute were elected at the group's annual meeting in Chicago, Sept. 27-28. They are Walter E. Brown, executive vice president, Kiowa Corp., Marshalltown, Iowa, president, and W. G. Newton Jr., president, Newton-New Haven Co., West Haven, Conn., vice president.

RECEIVES DOEHLER AWARD: The annual Doehler Award was presented to Alfred F. Bauer, manager, Doehler-Jarvis Div., National Lead Co., at the annual meeting of the American Die Casting Institute in Chicago, Sept. 27. The award went to Mr. Bauer for his work in the production of the first aluminum diecast engine block for an American auto and his leadership in the custom diecasting industry.

PERSONALS: Walter E. Illig, executive vice president, Banner Iron Works, St. Louis, has been elected president, succeeding the late J. B. Frielingsdof . . . Will Mitchell Jr. has been appointed director, Research Div., Allis-Chalmers Mfg. Co., Milwaukee . . . Charles C. Gates Jr. succeeds his late father as president of Gates Rubber Co., Denver . . . John W. Thornton has been named vice president and general manager, Industrial Div., Joy Mfg. Co., Pittsburgh . . . Howard Ripper, formerly sales manager, Globe Steel Abrasives Co., Mansfield, Ohio, has been appointed executive vice president, Pittsburgh Crushed Steel Co. and its subsidiaries. He will remain in Mansfield . . . Robert E. Morken has been named product manager in charge of melting furnace engineering and sales, Hevi-Duty Electric Co., Watertown, Wis. Recently he was a consultant on heat treating and melting for Chrysler Corp.

OBITUARY: Oscar E. Ross, 64, founder and president of Portsmouth Casting Inc., Portsmouth, Ohio, died Sept. 5 . . . Victor H. Bohl, 63, general superintendent, Kirsh Foundry, Beaver Dam, Wis., died Sept. 1 . . . Perry A. McArthur, for the last 23 years sales representative, S. Obermayer Co., Chicago, died Sept. 3.



PRODUCTION WORKERS

Estimated Number

	June 1961	May 1961	June 1960
Ferrous	175,700	172,900	193,100
Nonferrous	46,800	45,600	50,300

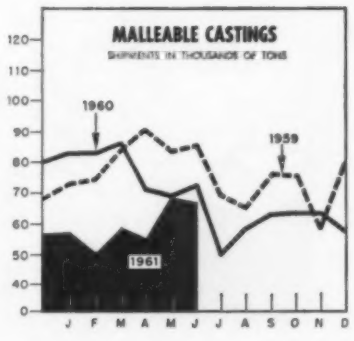
Average Weekly Earnings

Gray Iron	100.30	98.64	96.43
Malleable Iron	96.86	99.04	91.96
Steel	106.40	102.29	103.62
Nonferrous	103.83	102.54	101.91

Average Weekly Hours

Gray Iron	39.8	39.3	39.2
Malleable Iron	38.9	39.3	38.0
Steel	40.0	38.6	39.7
Nonferrous	40.4	39.9	40.6

Source: Bureau of Labor Statistics.



ALUMINUM CASTINGS

(Shipments of castings—1000 pounds[1])

	Shipments				Unfilled
	Total	Sand	Perm. Mold	Die	Orders[2]
1959	786,399	141,987	274,855	368,101	.....
1960					
June	60,068	11,280	20,953	27,722	74,699
6 mo.	394,357	70,313	130,805	192,617	.....
July	45,694	8,765	15,804	20,973	76,434
Aug.	58,848	10,639	18,901	29,256	75,230
Sept.	62,116	10,514	22,031	29,527	75,144
Oct.	63,750	10,149	23,339	30,213	71,364
Nov.	63,408	9,901	23,612	29,831	73,032
Dec.	63,629	9,578	23,272	30,677	71,398
Total	751,802	129,859	257,764	363,094	.....
1961					
Jan.	60,774	10,210	21,821	29,904	63,729
Feb.	57,144	10,183	19,518	27,355	62,748
Mar.	62,518	10,715	21,454	30,246	62,883
Apr.	60,253	10,037	21,065	29,096	65,316
May	63,299	9,945	23,484	30,167	69,110
June	64,399	10,254	24,326	29,724	68,150
6 mo.	368,287	61,344	131,668	176,492	.....

[1]Source: Bureau of the Census. [2]For sale only.

MALLEABLE IRON CASTINGS

(Shipments of castings—net tons[1])

	Shipments		Standard		Pearlitic		Unfilled
	Total	For Sale	Total	For Sale	Total	For Sale	Orders[2]
1959	916,362	557,363	729,868	449,946	186,494	107,357	.....
1960							
June	72,593	43,105	55,956	34,526	16,637	8,579	63,920
6 mo.	465,355	262,693	360,416	210,464	104,939	52,229	.....
July	49,860	28,575	37,187	22,477	12,673	6,098	74,329
Aug.	58,785	36,765	46,522	29,077	12,263	7,688	69,853
Sept.	63,048	36,114	48,635	28,623	14,413	7,491	69,033
Oct.	63,521	35,492	47,932	27,813	15,589	7,679	66,616
Nov.	62,978	35,432	47,571	27,611	15,407	7,821	58,627
Dec.	57,154	31,500	43,319	24,729	13,835	6,771	54,657
Totals	820,701	466,571	631,582	370,794	189,119	95,777	.....
1961							
Jan.	57,697	34,064	43,778	27,104	13,919	6,960	52,171
Feb.	50,828	29,675	39,358	23,854	11,470	5,821	47,703
Mar.	58,464	33,531	45,747	26,711	12,717	6,820	45,477
Apr.	55,590	31,436	43,192	25,152	12,398	6,284	48,096
May	68,406	40,270	52,637	32,197	15,769	8,073	51,894
June	67,247	40,359	51,918	32,437	15,329	7,922	51,512
6 mo.	358,232	209,335	276,630	167,455	81,602	41,880	.....

Prices of Foundry Metals and Coke

(As of September 22, 1961)

FOUNDRY COKE

(Per net ton, f.o.b. ovens)

BEEHIVE

Connellsville	$18.00-18.50

OVENS

Birmingham	$30.35
Buffalo	32.00
Chattanooga	30.80
Detroit	32.00
Erie, Pa.	32.00
Indianapolis	31.25
Kearny, N. J.	31.25
Milwaukee	32.00
Neville Island (Pittsburgh)	30.75
New Haven, Conn.	31.00
Painesville, O.	32.00
Philadelphia	31.00
St. Louis	33.00
St. Paul	31.25
Swedeland, Pa.	31.00
Terre Haute, Ind.	31.25

PIG IRON

(Per gross ton, f.o.b. furnace)

	No. 2 Foundry	Malleable
Birdsboro, Pa.	$68.50	$69.00
Birmingham	62.50	65.50
Boston, deld.	75.70	76.20
Buffalo	66.50	67.00
Chester, Pa.	Nom.	Nom.
Chicago	66.50	66.50
Cleveland	66.50	66.50
Duluth	66.50	66.50
Erie, Pa.	66.50	66.50
Fontana, Calif.	75.50	....
Geneva, Utah	66.50	....
Granite City, Ill.	68.40	68.90
Neville Island (Pittsburgh)	66.50	66.50
Rockwood, Tenn.	62.50	66.50
Swedeland, Pa.	68.50	69.00
Toledo, O.	66.50	66.50
Troy, N. Y.	68.50	69.00
Youngstown, O.	....	66.50

NONFERROUS INGOT

(Cents per pound, carlots)

BRASS AND BRONZE: Red brass, No. 115, 32.00; tin bronze, No. 225, 41.25; No. 245, 35.75; high leaded tin bronze, No. 305, 36.00; No. 1 yellow, No. 405, 27.50; manganese bronze, No. 421, 31.25.

ALUMINUM: Primary alloy No. 13, 25.90; No. 43, 26.20; No. 195, 27.60; No. 214, 29.00; No. 356, 26.80; secondary, No. 12 alloy, 21.25. Deoxidizing grades: 22.75; No. 4, 19.50.

MAGNESIUM ALLOY: AZ91A, 40.75; AZ63A, AZ92A, AZ91C, 40.75; f.o.b. Velasco, Tex.

COPPER: Electrolytic 31.00, delivered Connecticut valley.

ZINC: High grade, 12.35, delivered. Diecasting alloy No. 3, 13.75; No. 2, 14.25, delivered.

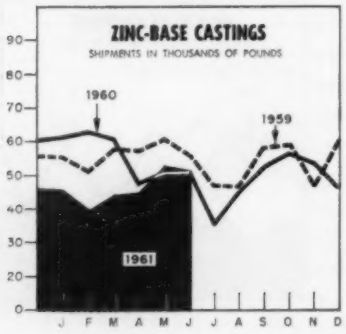
Iron and Steel Scrap

(Consumer prices per gross ton delivered, except as otherwise noted)

	No. 1 Heavy Melting Steel	No. 1 Cupola Cast	Heavy Breakable Cast	Machinery Cast	Structurals, Plates	Malleable	Short Steel Rails
Birmingham	$39.00-40.00	$42.00-43.00	.....	.....	$44.00-45.00	.....	$46.00-47.00
Boston*	**28.50-29.00	**39.00-40.00	.....	**40.00-42.00	.....	.....	.....
Buffalo	32.00-33.00	**37.00-38.00	.....	**44.00-45.00	40.00-41.00	.....	49.00-50.00
Chicago	41.00-43.00	44.00-45.00	.....	49.00-50.00	47.00-48.00	49.00-50.00	52.00-54.00
Cincinnati*	**35.00-36.00	**34.00-35.00	**30.00-31.00	**46.00-47.00	.....	.....	**48.00-49.00
Cleveland	38.00-39.00	39.00-40.00	28.00-29.00	48.00-49.00	43.00-44.00	50.00-51.00	50.00-51.00
Detroit*	33.00-34.00	34.00-35.00	27.00-28.00	.....	.....	.....	.....
Los Angeles	.....	.....	.....	.....	.....	.....	.....
New York*	30.00-31.00	34.00-35.00	22.00-33.00	.....	34.00-35.00	.....	.....
Philadelphia	40.00-41.00	40.00	42.00	49.00-50.00	45.00-46.00	49.00	.....
Pittsburgh	37.00-38.00	**34.00-35.00	.....	47.00-48.00	40.00-44.00	.....	53.00-55.00
St. Louis*	36.00	37.00	32.00	.....	.....	.....	46.00
San Francisco	43.00	47.00	28.00	45.00-46.00	.....	.....	.....
Seattle	46.00	41.00	28.00	.....	.....	.....	.....

Brokers' buying prices. **F.o.b. shipping point.

Foundry Statistics



ZINC-BASE CASTINGS

(Shipments of castings—1000 pounds[1])

	Shipments—Total	Shipments—For Sale	Unfilled Orders[2]
1959	631,210	443,009	.....
1960			
June	50,809	34,264	51,960
6 mo.	354,544	170,722	.....
July	35,117	25,186	52,392
Aug.	45,101	32,549	57,551
Sept.	52,514	34,451	57,480
Oct.	56,205	36,459	57,028
Nov.	53,574	33,758	55,306
Dec.	46,208	29,341	51,516
Totals	623,203	412,466	.....
1961			
Jan.	46,011	30,311	50,940
Feb.	39,946	26,715	45,453
Mar.	44,130	29,724	43,921
Apr.	44,853	30,225	47,853
May	52,615	34,453	50,054
June	51,240	34,548	45,975
6 mo.	280,795	185,976	.....

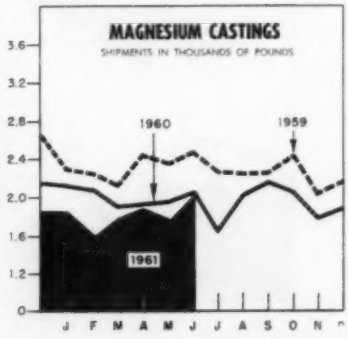
PIG IRON

PRODUCTION—Net Tons**

	Foundry	Malleable & Silvery	Low & Int. Low Phos. & Bessemer
1959	1,889,445	2,810,359	3,471,683
1960			
July	117,218	166,084	290,384
7 mo.	896,096	1,959,783	2,750,468
Aug.	78,950	171,718	211,506
Sept.	93,260	202,895	152,880
Oct.	133,525	183,639	208,758
Nov.	122,550	231,203	206,062
Dec.	130,455	153,009	202,353
Totals	1,454,836	2,902,247	3,732,027
1961			
Jan.	106,054	165,571	170,224
Feb.	98,207	144,476	214,396
Mar.	101,306	159,529	222,688
Apr.	114,050	150,322	189,779
May	118,211	166,365	215,093
June	97,060	186,127	240,287
July	100,404	164,272	289,046
7 mo.	736,828	1,136,663	1,541,512

CONSUMPTION*—Gross Tons

	Cupola	Air	Electric
1959	3,989,129	223,868	351,355
1960			
May	292,407	15,730	19,877
5 mo.	1,541,407	91,459	189,626
June	313,340	16,828	23,729
July	241,752	11,892	21,123
Aug.	273,722	14,697	27,919
Sept.	284,809	13,548	19,962
Oct.	269,103	13,631	13,947
Nov.	254,799	12,867	17,567
Dec.	233,592	12,722	18,344
Totals	3,412,524	187,644	331,200
1961			
Jan.	232,051	13,293	16,375
Feb.	225,222	12,195	21,705
Mar.	251,524	13,922	18,646
Apr.	242,415	12,208	20,412
May	274,837	13,887	20,262
5 mo.	1,226,049	65,505	97,400



MAGNESIUM CASTINGS

(Shipments of castings—1000 pounds[1])

	Shipments—Total	Shipments—For Sale	Unfilled Orders[2]
1959	27,253	23,100	.....
1960			
June	2,050	1,555	3,396
6 mo.	12,042	9,393	.....
July	1,638	1,234	3,541
Aug.	2,025	1,530	3,364
Sept.	2,146	1,653	3,271
Oct.	2,038	1,519	3,274
Nov.	1,776	1,269	3,433
Dec.	1,875	1,345	3,156
Total	23,540	17,943	.....
1961			
Jan.	1,862	1,436	2,847
Feb.	1,610	1,206	2,770
Mar.	1,791	1,360	2,476
Apr.	1,809	1,439	2,888
May	1,764	1,338	2,910
June	2,046	1,460	3,390
6 mo.	10,882	8,239	.....

*Source: U. S. Dept. of Interior, Bureau of Mines. **Source: American Iron & Steel Institute. [1]Source: Bureau of the Census. [2]For Sale only. [3]Monthly figures may not add up to totals shown because of unreported monthly revisions.

Say Goodbye to

RAT-TAILS · BUCKLES · SCABS

PAN X TROL®

(X–PAN–TROL)

ENDS DEFECTS OF SAND EXPANSION

X-PAN-TROL is used for gray iron, ductile iron, aluminum, brass, and bronze castings when made in green sand, either synthetically or naturally bonded.

X-PAN-TROL can often be used to replace skin-drying of molds when the skin-drying is for overcoming rat-tails, buckles, and scabs caused by green sand expansion.

Write or call for further information, literature

Whitehead Brothers COMPANY

Established 1841

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NEW ENGLAND OFFICE
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Manufacturers of

LYQUAGRIP
Ready-to-use core paste

DUO RESIN
Binder for baking with controlled oven temperatures

JOINT SEAL
Plastic compound for perfect sealing

LYQUAFACE
The liquid sand grain coating

DOB-IT
Ready-to-use core mudding compound

HEATING or MELTING LARGE VOLUMES of METAL?

NEW TRI-LINE* 180-Cycle Static Frequency Multipliers

extend induction power to a wider range of applications — often at lower cost.

If your production involves large-scale heating or melting, it will pay you to investigate the cost and performance advantages of Inducto Tri-Line 180-Cycle Static Frequency Multipliers. These medium-frequency units fill the gap between Inductotherm high-frequency and Inductotherm Linemelt low-frequency heating and melting equipment. In a wide range of melting, sintering, hot-pressing and graphitizing applications, they offer some unusual economies.

MEET CHANGING LOAD CONDITIONS. The Tri-Line's special transformers and controls, produce 180-cycle current from a balanced 60-cycle, 3-phase input with remarkable flexibility of output to meet changing load conditions.

SUPERIOR STIRRING—INCREASED PENETRATION. Tri-Line units generate stirring forces about 2½ times those of comparable high-frequency induction melting furnaces. You can now maintain the proper amount of stirring in large furnaces to assist in formulating many alloys containing metals of widely varying densities. Also, the increased penetration of 180-cycle power assures improved performance in heating relatively large diameter billets and dies.

*Trademark

CONVENIENT, SAFE OPERATION. Overloads cause no damage. Simple, virtually automatic operation is quickly learned by unskilled personnel.

GET FULL DETAILS. Inducto Tri-Line Multipliers are available with Kw output capacities, furnaces, heating coils and accessories to suit any medium-frequency application. For full information regarding efficiencies and economies in your particular job, ask to have an Inducto Field Engineer call.

Inductotherm Corp., 10 Indel Avenue, Rancocas, N. J.

STEEL SHELL FURNACES, available with any Tri-Line installation, offer significant improvements in rigidity and vibration resistance to greatly prolong lining life. In the illustration, pure nickel is being poured from a 5,000 pound steel shell furnace powered by a 500 Kw Inducto Tri-Line installation at Seaway Nickel Corp., N. Tonawanda, N. Y.

INDUCTOTHERM

Subsidiary for 60-cycle melting equipment—INDUCTOTHERM LINEMELT CORP.

Joseph C. Sullivan, Foundry's Pittsburgh Manager, Dies

Joseph C. Sullivan, 47, Pittsburgh district sales manager for FOUNDRY, died in that city, Sept. 13. He had been ill since May. Mr. Sullivan

JOSEPH C. SULLIVAN

joined the Penton Publishing Co. in 1936 as assistant editor of *Steel*. From 1945 until 1951 he was Pittsburgh district editor of FOUNDRY and other Penton publications. For the next nine years he was Pittsburgh district sales manager for *Steel*, and had served in a similar capacity for FOUNDRY since June, 1960.

AFS Opens Apprentice Contest

The 1962 Robert E. Kennedy Memorial Apprentice Contest for molding and patternmaking, sponsored by the American Foundrymen's Society, opens Oct. 1. The contest is held annually to stimulate development of individual skills and craftsmanship in patternmaking and molding.

The five divisions of the contest are wood patternmaking, metal patternmaking, gray iron molding, steel molding and nonferrous molding. In each division, judging of entries is based on considerations of workmanship and time spent. Closing date for the contest is March 26, 1962.

Information about the contest can be obtained by writing to R. E. Betterley, educational director, American Foundrymen's Society, Golf and Wolf Roads, Des Plaines, Ill.

AFS Approves Plans for T & R I

● DIRECTORS of the American Foundrymen's Society have approved plans for construction of a $600,000 Training and Research Center. It is to be located on land adjacent to AFS headquarters in Des Plaines, Ill.

The building will have about 19,000 sq ft of floor space for research, practical training work, and classrooms. Architectural plans for the building already have been completed.

Completion of the new center is expected to greatly facilitate the series of training courses instituted several years ago, using temporary facilities in various sections of the country. To date some 2000 persons from more than 750 companies have attended these courses. In addition, the center will be able to offer training of newly graduated engineers in foundry practice.

A recent U. S. Treasury Dept. ruling which gives the institute tax exemption is the big factor in permitting it to proceed with its expanded program.

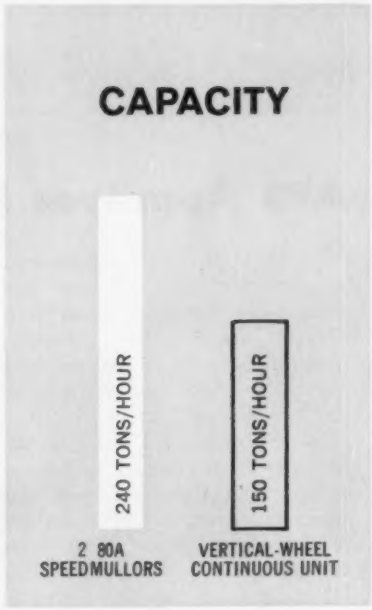
Establishment of the new center will not affect the various basic research projects now being conducted at universities and elsewhere, according to Albert L. Hunt, AFS president. "The institute will continue to assign and conduct its research projects wherever maximum effort per research dollar can be obtained."

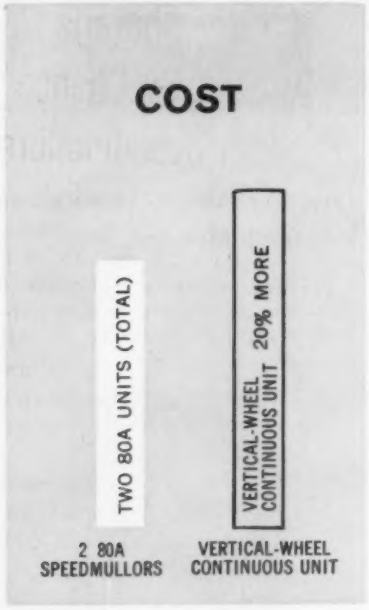
AFS directors have authorized a new class of membership in the society—Research Patrons, whose dues will be devoted largely to implementing research programs for the industry, in addition to industry's own contributions to the T & R I.

RECEIVES FEF SCHOLARSHIP: Dennis J. Moore, center, who received the first Foundry Educational Foundation scholarship at Wentworth Institute, Boston, is congratulated by H. Russel Beatty, left, president of the school. On the right is J. Gerin Sylvia, senior instructor, foundry department. Mr. Moore is enrolled in the metals technology program and will graduate in 1962. FEF scholarships for technical institutes were set up through special contributions by American Brake Shoe Co., Dow Chemical Co., and Griffin Wheel Co.

You Pick the Quality Level

SPEEDMULLORS PROVIDE MORE SAND, MORE UNIFORMITY, AT LOWER COST



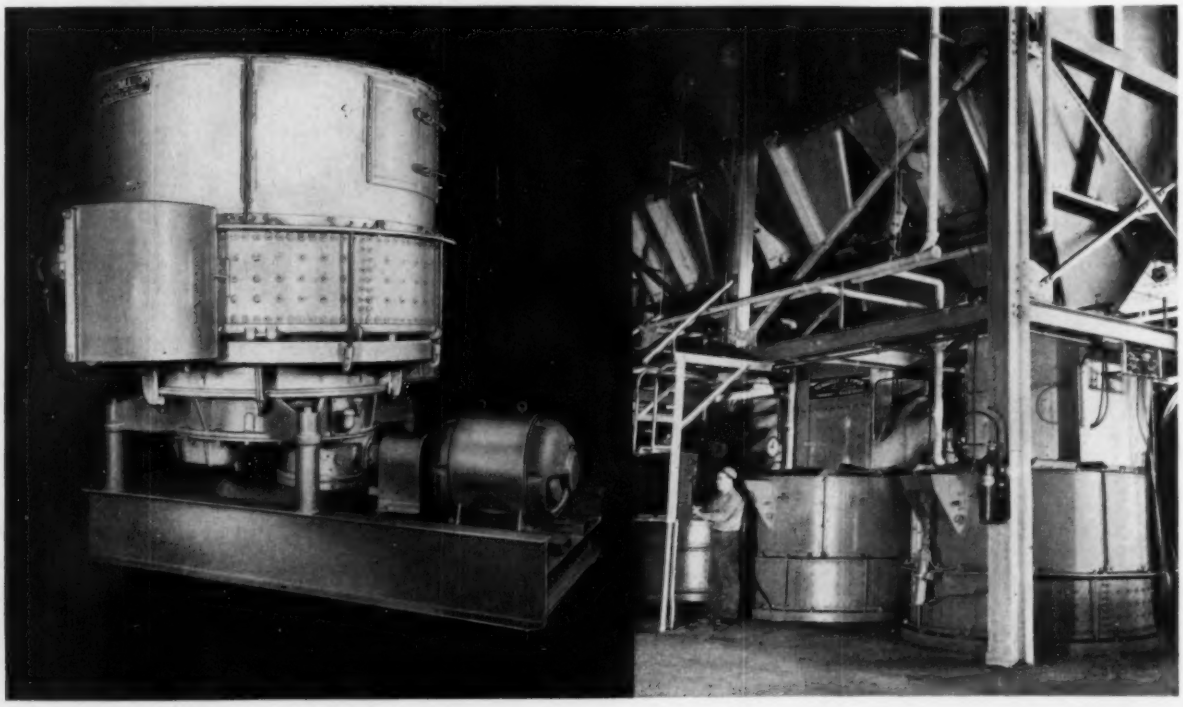


Compare an '80A' Speedmullor to any Continuous Unit

Not all foundries require the same quality sand. Not all foundries require the same capacities. But, for the greatest capacity *at any desired physical property level*, the Speedmullor provides sand of greater uniformity...and at appreciably lower cost per ton.

Two model '80A' Speedmullors, operating on a thirty-second cycle will produce 240 tons of mulled sand per hour while developing physical properties exceeding those in any other two mullers or in any vertical-wheel or other continuous unit, under comparable conditions, and with like amounts of binding material.

One manufacturer's figures show a vertical-wheel continuous unit, at 20% greater cost than the two Speedmullors, producing only 150 tons per hour—without developing Speedmullor quality or Speedmullor uniformity. Why be content with high cost and non-uniformity, when Speedmullor batch-type control produces the greatest capacity at your required physical property level and at far lower cost?



There Is No "Mulling By Chance" With Speedmullors

Consistently high quality castings are assured only when *all* the sand delivered to the molding department is developed to the fullest physical properties desired. Uniformity is the key to reduced scrap losses and only the Speedmullor combines unmatched uniformity with the *greatest capacity while developing your required physical properties.*

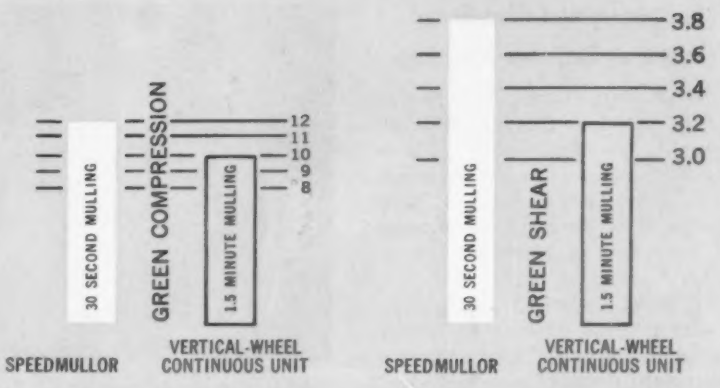
The Speedmullor assures precise control of all sand properties, and Speedmullor batch mulling eliminates non-uniform mulling time with the possibility of "insufficient mulling" which results in "brittle" sand. In the Speedmullor all sand is subjected to the same mulling...each batch is uniform...each batch exactly controlled. No vertical-wheel muller—and certainly no combination of vertical-wheel mullers—can approach this control. Moisture and bond must be "averaged" into any continuous unit, but a molder must use the sand in his bin...*averaged properties don't help if his sand is not uniform.*

Precise control saves additional sand preparation dollars by eliminating over-bonding and excessive binders in your sand system. Moisture control is more exact—flowability more perfect—permeability higher.

Much as the charts shown offer proof of Speedmullor superiority, we are ready to demonstrate this superiority to you in person at our technical center. Your Beardsley & Piper representative will be happy to arrange a visit.

QUALITY

Typical results in field comparisons with sand that required minor rebonding and tempering.



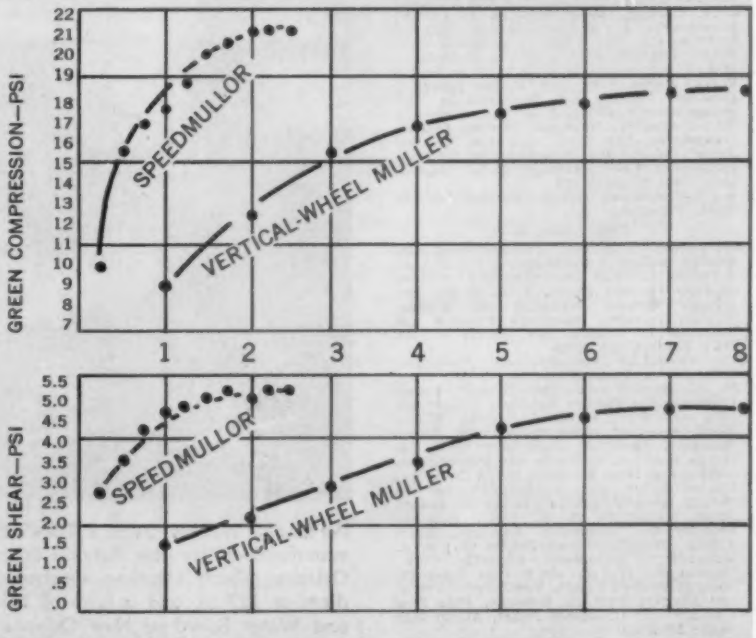
BEARDSLEY & PIPER Div. of Pettibone Mulliken Corp.
2424 N. Cicero Ave., Chicago 39, Ill.

SPEEDMULLOR VS VERTICAL-WHEEL BATCH MIXER...REPORT OF AN ACTUAL WITNESSED COMPETITIVE MULLING TEST

Return system sand from heavy casting units supplied by a large gray iron foundry ...comparative testing witnessed by operating foundry personnel...2200 lbs. sand with additions of 2% Southern Bentonite —7% Western Bentonite—3% Combustible Materials.

	Green Compression	Green Shear
Speedmullor 30 seconds	15.5 psi	3.5 psi
Vertical-Wheel Mixer 3 min.	15.3 psi	3.0 psi
Speedmullor 60 seconds	17.8 psi	4.7 psi
Vertical-Wheel Mixer 6 min.	17.6 psi	4.5 psi

Note! Vertical-wheel batch muller requires 3 minutes to develop similar physical properties to those attained in the Speedmullor in 30 seconds. The same ratios prevail throughout the mulling cycle. A vertical-wheel continuous muller provides average total mulling time of only 1.50 minutes (per information published)...the equivalent of less than 20 seconds of Speedmullor mulling.



For More Information Circle 568, Page 39

Ohio Foundrymen Plan Broad Program at Regional Meeting

"Changing Times" will be the theme of the ninth Ohio Regional Foundry Conference, to be held at the Netherland-Hilton, Cincinnati, Oct. 5-6. The meeting is being sponsored by the five Ohio chapters of the American Foundrymen's Society.

A broad technical program includes general sessions on Thursday morning and Friday afternoon, with eight sectional meetings scheduled for Thursday afternoon and Friday morning. Luncheon sessions are scheduled for both days, and a dinner will be held on Thursday evening.

Heading the program committee are Harry E. Placke, Sidney Aluminum Products Inc., Sidney, Ohio, chairman, and Norman Stickney, Sand Products Co., Cleveland, vice chairman. Program details follow:

Thursday, Oct. 5

10 a.m.—Use of Furans in the Foundry—Joseph P. Cummins, International Harvester Co.; George Bivans, Standard Steel Works; Wayne Buell, Aristo Corp.; Robert J. Mulligan, Archer-Daniels-Midland Co.

2-3:15 p.m.—Sectional Meetings. Use of Fine Synthetic Sands for Aluminum and Brass Castings, George Schultz, Reliable Castings Corp. **How To Louse Up a Cupola,** T. E. Barlow, International Minerals and Chemical Corp. **Rammed Mold Hardness vs Casting Dimensions,** Joseph Schumacher, Hill & Griffith Co. **Hot Box Corebox Design,** Ernest Harkess, Ford Cleveland Foundry.

3:30-5:15 p.m.—Surface Finish as a Selling Point, James Voss and Joseph Leverton, Hamilton Foundry Co. **Inclusions in Aluminum Alloy Castings,** J. M. Fox, Aluminum Co. of America. **Machined Patterns Can Be Competitive,** Ray Olson, Southern Precision Pattern Works Inc. **Specifications for Production of Steel Castings,** Glenn Hughes, Ohio Steel Foundry Co.

7 p.m.—Conference Dinner. Speaker, W. G. Gude, FOUNDRY.

Friday, Oct. 6

9-10:30 a.m.—Sectional Meetings—Statistical Quality Control in the Foundry, Ben Frazer, American Standard Corp. **Ceroxides—a Study of Steel Foundry Sands,** J. B. Caine, consultant. **Vacuum Degassing and Melting,** William Johnson, Shenango Furnace Co. **Problems in Ductile Iron,** David Matter, Ohio Ferro-Alloys Corp.

10:45 a.m.-12:15 p.m.—Sectional Meetings—Kiss Gating Brass Castings, C. W. Ward Jr., American-Standard Corp. **Foundry Trends Challenge the Pattern Industry,** Walter Siebert, Cleveland Standard Pattern Works. **Metal Analysis' Relationship with Brinell Hardness,** Frederick Cash, Gray Iron Research Institute. **Malleable and Pearlitic Annealing and Heat Treating,** Ralph Davis and Eugene Baker, Dayton Malleable Iron Co.

1:45-3:15 p.m.—Trends in Casting Tolerances. Panel discussion; R. R. Deas, Hamilton Foundry Co., moderator. Speakers: Harry Kindle, Cummins Diesel Engine Co.; S. A. McCarthy, McDonnell Aircraft Corp.; Charles F. Walton, Gray Iron Founders' Society; Herbert Scobie, Non-Ferrous Founders' Society; Paul E. Eubanks, Ohio Steel Foundry Co.; C. Russell Baker, Albion Malleable Iron Co.

GIRI MEETING: Trustees of the Gray Iron Research Institute shown at a meeting in Cleveland for their annual discussion of the organization's activities

Schedule Sessions on Foundry Topics at Magnesium Meeting

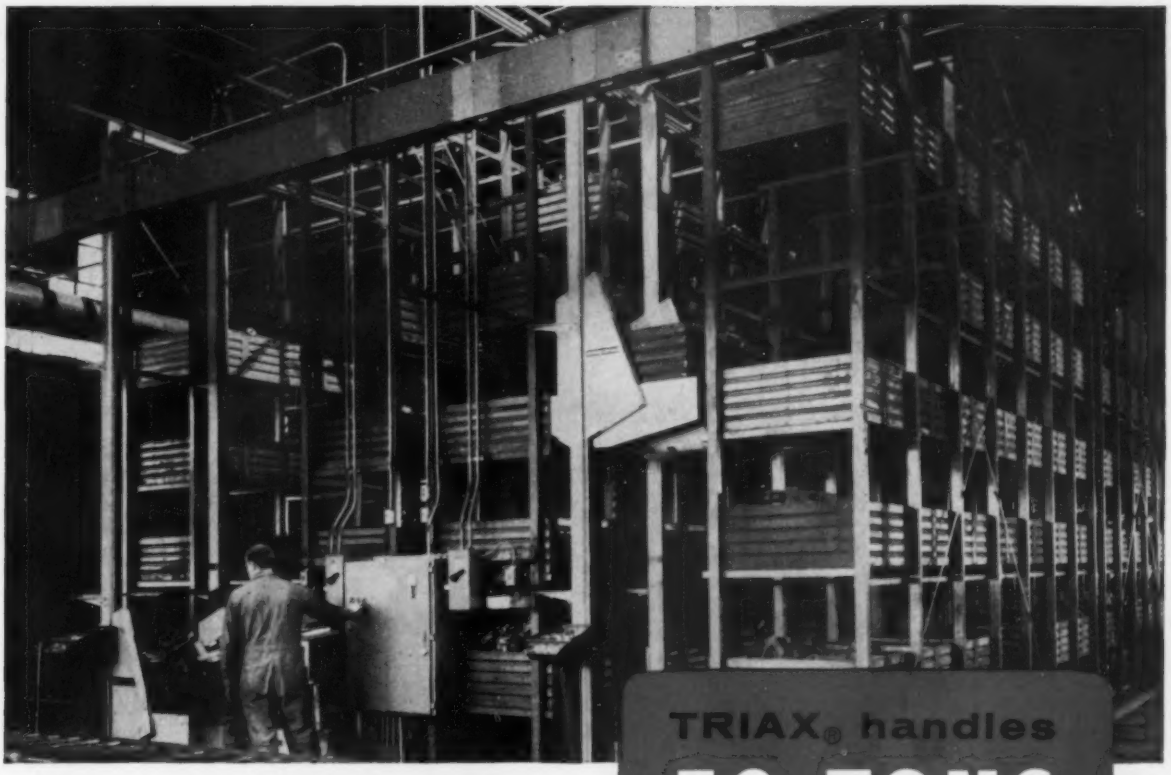
The Magnesium Association will hold its 17th annual convention at the Belmont Plaza Hotel, New York, on Oct. 16-18. General theme of the meeting will be "Magnesium in Focus" and a feature will be an exhibit of "101 Commercial Uses of Magnesium."

Speakers who will discuss subjects related to cast metals include John T. Berry, Armour Research Foundation, who will explain strengthening processes indicated in experimental techniques for casting magnesium; and A. E. Swanson, Doehler-Jarvis Div., Batavia, N. Y., who will outline a case history on using magnesium diecastings.

One technical session is devoted to a panel presentation titled "Standards and Specification — Guide to Mutual Understanding." Moderator will be I. V. Williams, Bell Laboratories, and members will

(*Concluded on Page* 30)

IMPELLERS WEIGH OVER 8 TONS EACH: Shown here is one of four impellers manufactured by the Service Foundry Div., Avondale Shipyards Inc., New Orleans. Each impeller weighed 17,600 lb before machining and has a diam of 127 in. and a bore of 14½ in. They will be used by the Sewerage and Water Board of New Orleans in a drainage system installation



One man, operating two TRIAX "Retriever" units, moves up to 50 tons of partially finished castings per 8-hour shift in or out of storage.

TRIAX® handles

50 TONS

OF CASTINGS

A DAY

Automatically!

SAVES SPACE — SAVES LABOR
ALL LOADS QUICKLY AVAILABLE

At the Marion Malleable Iron Works, Marion, Indiana, TRIAX Retrievers were installed to fulfill several different needs . . . to save time and labor, to save space, and to establish an accurate method of inventory control.

Now, one man can store or remove loaded boxes of castings from any one of 520 storage openings in an average cycle time of 2½ minutes by setting a few simple pushbuttons.

Estimates in savings of time and labor run to 33% each and an index card file tells the operator exactly which castings he has in storage. Production orders can be filled quickly and accurately.

In other TRIAX installations, Retrievers are being used to store tools and dies, electric motors, sub-assemblies and finished parts, huge rolls of plastic film and other types of products. We would welcome the chance to discuss the advantages of a Retriever for your plant or warehouse.

THE TRIAX COMPANY

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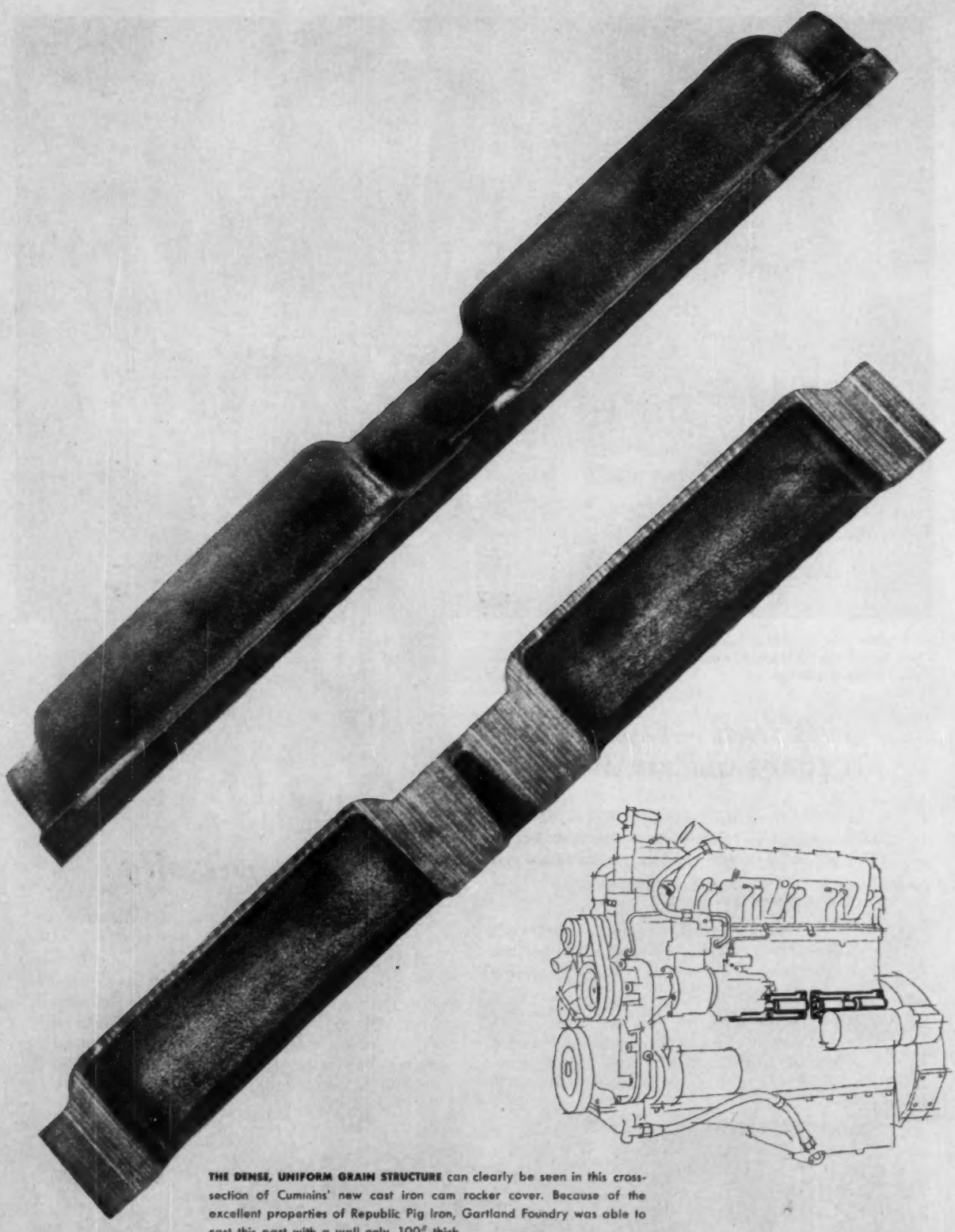
For More Information Circle 589, Page 39



THE DENSE, UNIFORM GRAIN STRUCTURE can clearly be seen in this cross-section of Cummins' new cast iron cam rocker cover. Because of the excellent properties of Republic Pig Iron, Gartland Foundry was able to cast this part with a wall only .100" thick.

CAST IRON DOES IT AGAIN!

Cast iron cam rocker cover replaces non-ferrous casting

The Gartland Foundry Company of Terre Haute, Indiana, is helping Cummins Diesel cut both costs and weight on heavy-duty truck engines. The method: production of a new lightweight, low-cost cam rocker cover with a .100″ wall, cast with Republic Pig Iron as the base metal.

This part was originally cast iron, but it weighed 6½ pounds. To cut weight, Cummins switched to a non-ferrous die casting. Then Gartland produced a new cast iron cover weighing only 3 pounds 11 ounces, costing much less than the non-ferrous cover, and allowing a total weight saving of more than 8 pounds per engine.

The uniform chemistry and consistent high quality of Republic Pig Iron helped make this possible. Thousands of customers rely on Republic Pig Iron for strong, flaw-free, economical and easy-to-machine castings. Consider these advantages in terms of your own production . . . then contact your nearest Republic representative or simply mail the coupon below.

REPUBLIC STEEL

PRODUCERS OF INDUSTRY'S MOST COMPLETE LINE OF MERCHANT PIG IRON

REPUBLIC'S COMPLETE FOUNDRY ENGINEERING SERVICE is available to all foundries without obligation. Republic Foundry Service Engineers can supply ideas, suggestions, and information to benefit every department of your foundry operation. They can recommend, from industry's most complete line of merchant pig iron, the grade best suited to your requirements: Chateaugay; Northern Foundry, Malleable, Bessemer and Basic; Southern Foundry, Malleable and Basic.

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☐ Send more information on Republic Pig Iron.

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Company_____

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For More Information Circle 570, Page 39

be William Freeman, Lycoming; A. A. Moore, Dow Metal Products; J. Jakobowski, General Electric Co.; K. E. Nelson, Wellman Bronze & Aluminum Co.; and W. G. Groth, George C. Marshall Space Flight Center, Huntsville, Ala.

J. D. Robinson, Bendix Aviation Corp., South Bend, Ind., will moderate at a Monday afternoon session on precision castings, quality, and tolerances.

Additional program details can be obtained from the association at 122 E. 42nd St., New York 17, N. Y.

Introduces New Safety Contest

The Gray Iron Founders' Society, Cleveland, has introduced a new safety contest that recognizes the efforts of a firm in setting up an organization within the plant to combat accidents. No accident statistics are directly involved in qualifying a foundry for the award, although the society predicts that a firm which qualifies will have a comparatively good accident record.

The new idea rectifies, to a large extent, the hardship placed on the small plant which competes with larger units strictly on the basis of a frequency or severity accident rate where the manhour exposure factor is so important. The award, however, will not be a substitute for those based on accident records.

Ford Cleveland Foundry Sets New Industry Safety Record

Ford Motor Co.'s Cleveland foundry has established a new foundry industry record of 3,421,133 manhours worked without a disabling injury. For this accomplishment, Ernest E. Harkess, foundry manager, was presented with the National Safety Council's award of honor at the Northern Ohio Safety Conference, held Sept. 12 at Hotel Carter, Cleveland. The new record was made during the six-month period from Jan. 20 to July 29, this year.

The previous record of 2,916,971 manhours was held by the Ford specialty foundry, Dearborn, Mich.

The Cleveland foundry employs 4200 workers. During a normal two-shift day, it uses 1100 tons of prepared core sand and at peak production can melt 2500 tons of iron daily. It has the capacity to make more than 10,000 engine blocks a day.

Factors which contributed to setting the record include requiring workers to wear safety glasses and many types of protective clothing. The plant emphasizes good housekeeping and creates an awareness of hazards in the minds of employees. All phases of the safety program are under the direction of safety engineers.

TRAVELING EXHIBIT: American trade publications, including FOUNDRY, make up this display by the U. S. Commerce Department. The exhibit is set up at foreign trade fairs to acquaint businessmen abroad with our industries

These Dealers stock Baroid's

NATIONAL

Western Bentonite

American Steel and Supply Company, Chicago, Illinois
Asbury Graphite Mills, Inc., Asbury, New Jersey
Asher-Moore Company, Richmond, Virginia
Brandt Equipment and Supply Company, Houston, Texas
George W. Bryant Core Sands, Inc., McConnellsville, New York
The Buckeye Products Company, Cincinnati, Ohio
Canadian Foundry Supplies & Equipment Ltd., Montreal 30, Quebec (Main Office)
Canadian Foundry Supplies & Equipment Ltd., Toronto 14, Ontario
Combined Supply & Equipment Company, Buffalo, New York
Foundries Materials Company, Coldwater, Michigan
Foundries Materials Company, Detroit, Michigan
Foundry Service Company, Birmingham, Alabama
General Refractories Company, Indianapolis, Indiana
The Hoffman Foundry Supply Co., Cleveland, Ohio
Independent Foundry Supply Company, Los Angeles, California
Industrial & Foundry Supply Company, Oakland, California
Interstate Supply and Equipment Co., Milwaukee, Wisconsin
Klein-Farris Company, Inc., Boston, Massachusetts
La Grande Industrial Supply Co., Portland, Oregon
Marthens Company, Moline, Illinois
Midvale Mining and Manufacturing Co., St. Louis, Missouri
Carl F. Miller and Company, Inc. Seattle, Washington
John P. Moninger. Elmwood Park, Illinois
Pennsylvania Foundry Supply & Sand Co., Philadelphia, Pennsylvania
Robbins and Bohr, Chattanooga, Tennessee
Smith-Sharpe Company, Minneapolis, Minnesota
Steelman Sales Company, Munster, Indiana
Warner R. Thompson Company, Detroit, Michigan
Western Materials Company, Chicago, Illinois

Write today for BOOKLET giving further information on the benefits gained from using NATIONAL Western Bentonite.

BAROID

BAROID CHEMICALS, INC.

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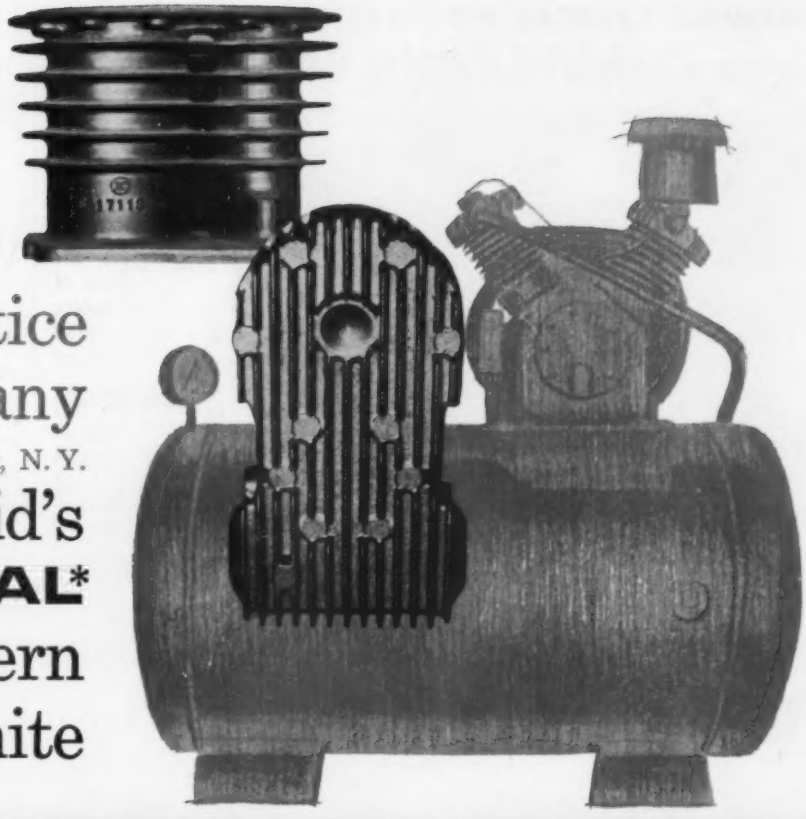
For More Information Circle 571, Page 39



The Anstice Company

of Rochester, N. Y.

uses Baroid's NATIONAL* Western Bentonite

for gray iron compressor castings

The Anstice Company, Rochester, New York, uses NATIONAL Western Bentonite as the sand-bonding agent for a wide variety of gray iron castings. The compressor head and cylinder body castings illustrated here are excellent examples of the success Anstice has had with NATIONAL Western molding sands.

Baroid's NATIONAL Western Bentonite helps produce close tolerance, fine-finish castings of all metals—steel, malleable iron, gray iron, brass, aluminum or magnesium.

For good molding, better cores and high-refractory core wash formations, use NATIONAL Western. NATIONAL cores dry faster, have higher dry strength and contain less gas.

*Registered Trademark, National Lead Company

BAROID

BAROID CHEMICALS, INC.

A SUBSIDIARY OF NATIONAL LEAD COMPANY
1809 SOUTH COAST BLDG., HOUSTON 2, TEXAS

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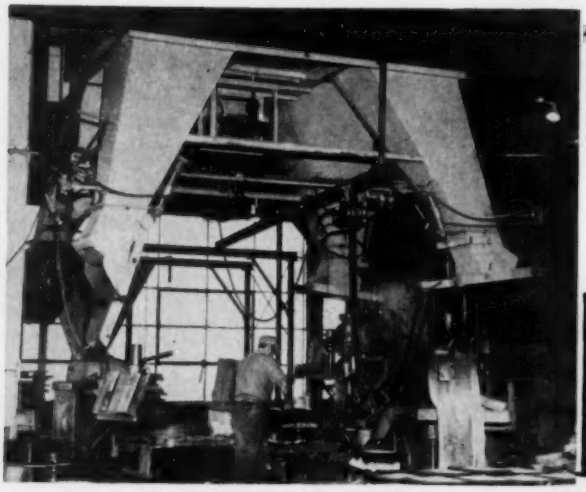
For More Information Circle 571, Page 39

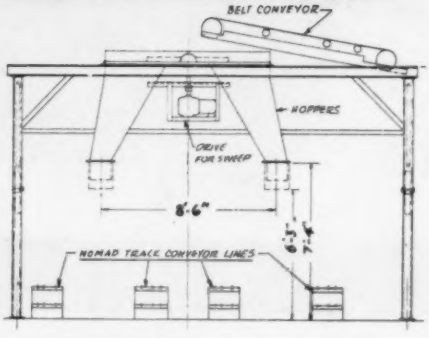
NOMAD CLUSTER HOPPERS*
give SPACE-SAVING COMPACTNESS



*Cluster Hoppers are an original design engineered by NOMAD EQUIPMENT

Typical standard layout showing low headroom dimensions and compact design.

A single unit of four 25 cu. ft. hoppers supplies free-flowing sand to four molders within an area of 17'-6" x 6'-6".



NOMAD HOPPERS FEATURE THESE ADVANTAGES:

BACK-BREAKING WORK IS REDUCED!

No shoveling is needed when Cluster Hoppers are used. The overhead supply of sand greatly reduces the amount of physical effort required.

PRODUCTIVITY IS INCREASED!

The molder who does not have to shovel *conserves energy* and is able to make more molds in a given time.

LOW HEADROOM

Minimum height to serve squeezers is 15 feet. Standard height to the top of the Hopper is 12'-9".

EASY INSTALLATION

This is usually built as one unit which is placed in position, elevated to the correct height and supports added. Can be supported independent of the building structure.

Write Today for information on how a NOMAD CONVEYOR SYSTEM can make you more competitive!

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3110 W. FOND DU LAC AVE., MILWAUKEE 10, WIS.
Designers and Manufacturers of Complete Conveyor Systems

NOMAD EQUIPMENT

Calendar of MEETINGS

Oct. 3—Hoist Manufacturers Association, fall meeting, Statler Hilton Hotel, Cleveland.

Oct. 5-6—Ohio Regional Foundry Conference, Netherland Plaza Hotel, Cincinnati.

Oct. 5-6—Congress of German Foundrymen's Associations, Dusseldorf, Germany.

Oct. 7-10—Conveyor Equipment Manufacturers Association, annual meeting, Ponte Vedra Inn, Ponte Vedra Beach, Fla.

Oct. 10-12—American Standards Association Inc., national conference, Rice Hotel, Houston.

Oct. 13-14—New England Foundry Conference, Massachusetts Institute of Technology, Cambridge, Mass.

Oct. 16-18—Magnesium Association, annual convention, Belmont Plaza Hotel, New York.

Oct. 18-20—Gray Iron Founders' Society, annual meeting, Royal York Hotel, Toronto, Ont.

Oct. 19-20—Michigan Regional Foundry Conference, Kellogg Center, Michigan State University, East Lansing, Mich.

Oct. 19-21—Foundry Equipment Manufacturers Association, annual meeting, Greenbrier, White Sulphur Springs, W. Va.

Oct. 23-27—American Society for Metals, National Metal Congress & Exposition, Cobo Hall, Detroit.

Oct. 26-27—Purdue Metals Casting Conference, Purdue University, Lafayette, Ind.

Oct. 29-31—Fluid Controls Institute Inc., fall meeting, Hotel Hershey, Hershey, Pa.

Oct. 29-Nov. 1—National Metal Trades Association, annual convention, Commodore Hotel, New York.

Oct. 30-Nov. 1—Material Handling Institute Inc., joint industry meeting with Industrial Truck Association, Association of Lift Truck & Portable Elevator Manufacturers, and Monorail Manufacturers Association, Greenbriar, White Sulphur Springs, W. Va.

Nov. 1-2—Investment Casting Institute, annual meeting, Park-Sheraton Hotel, New York.

Nov. 1-3—Malleable Founders Society, 12th annual Market Development Conference, Hotel Sheraton-Cleveland, Cleveland.

Nov. 13-15—Steel Founders' Society of America, Technical & Operating Conference, Hotel Pick-Carter, Cleveland.

Nov. 15-17—National Foundry Association, annual meeting, Savoy-Hilton Hotel, New York.

Nov. 27-29—Plumbing Brass Institute, annual meeting, Savoy-Hilton Hotel, New York.

Nov. 27-Dec. 1—28th Exposition of Chemical Industries, New York Coliseum, New York.

Dec. 6-8—American Institute of Mining, Metallurgical, & Petroleum Engineers, Electric Furnace Conference, Penn-Sheraton Hotel, Pittsburgh.

1962

Jan. 22-23—Industrial Heating Equipment Association, annual winter meeting, Drake Hotel, Chicago.

Feb. 6-8—Material Handling Institute Inc., spring meeting, Hilton Inn, Atlanta.

Feb. 8-9—Wisconsin Regional Foundry Conference, Schroeder Hotel, Milwaukee.

March 12-13—Steel Founders' Society of America, annual meeting, Drake Hotel, Chicago.

March 15-16—Texas Regional Conference, Hotel Menger, San Antonio, Tex.

May 7-11—American Foundrymen's Society, 66th Annual Castings Congress & Exposition (held in conjunction with the 29th International Foundry Congress), Cobo Hall, Detroit.

Sept. 1-9—German Foundry Trade Fair and annual meeting, German Foundrymen's Technical Association, Dusseldorf, Germany.

Sept. 25-28—Society of Diecasting Engineers, 2nd National Diecasting Exposition & Congress, Cobo Hall, Detroit.

For More Information Circle 572, Page 39

Cut metal cleaning costs with blasting

Pressure blasting with Norton ARROW-BLAST abrasive will save money every step of the way on most of your metal cleaning jobs — because of the high cutting efficiency and longer life of ARROW-BLAST grain. Composed of fused alumina grains that are tough, hard and sharp, ARROW-BLAST abrasive has high resistance to breakdown so that it can be used repeatedly through several cleaning operations. And unlike sandblasting, dust is negligible with ARROW-BLAST abrasive eliminating poor visibility and other hazards.

Norton NORBIDE* pressure blast nozzles add even more to the savings picture. Molded of boron carbide, the man-made material that's next to diamond in hardness, these nozzles have proven over and over that they have much lower overall operating cost than so-called "inexpensive" nozzles. NORBIDE nozzles cut costs right down the line — in replacement . . . operator downtime . . . air consumption.

An informative new report from Norton entitled "Pressure Blasting with Manufactured Abrasives," gives many details and operating facts about this efficient and economical metal cleaning process. For your copy, write NORTON COMPANY, General Offices, Worcester 6, Mass.

*Trade Marks Reg. U.S. Pat. Off. and Foreign Countries

NORTON
ABRASIVES

G-411

Making better products . . . to make your products better

NORTON PRODUCTS: Abrasives • Grinding Wheels • Machine Tools • Refractories • Non-Slip Floors — BEHR-MANNING DIVISION: Coated Abrasives • Sharpening Stones • Pressure-Sensitive Tapes

For More Information Circle 573, Page 39

How Ed Blumberg increased and cut wheel costs, too,

General Casting of Waukesha, Wisconsin, is one of the finest gray iron foundries in the Wisconsin area. A large number of the castings they make are unusually intricate in design. Many of them are used in hydraulic systems calling for the highest possible standards of quality and finish. Dental mirrors are even used to detect imperfections and no shadows are allowed . . . period!

They were perfectly happy with the resinoid cone wheels they had been using . . . until Bay State Abrasive Specialist Ed Blumberg came up with a silicon carbide cone with vitrified bond that did a considerably better job. To be specific, it cost less to buy and lasted 35% longer, too. On top of that, as Cleaning Room Foreman Cliff Raymond says, "these vitrified cones have an exceedingly fast cutting action."

To quote Ed Blumberg himself: "It's surprising how often a simple change of wheel spec. can make a really substantial improvement in performance or in the cost picture . . . or both."

Maybe it's time to check *your* grinding operations. Your Bay State representative, direct or distributor, is an excellent man for the job . . . widely experienced and thoroughly trained. He's backed by Research and Development, Quality Control, and Abrasive Engineering second to none.

Better grinding at lower cost . . . that is our business.

Bay State's Edward W. Blumberg was an Abrasive Specialist for four years before joining Bay State in 1951. Before that, he had wide experience in the machine tool business so his knowledge of abrasive and metals is unusually broad as well as highly detailed.

grinding wheel life 35%
at General Casting Corp.

Operator Raymond Hatch removes core fin from tractor clutch housing, using Bay State's fast-cutting silicon carbide cone wheel with vitrified bond.

Plant Superintendent Paul Dumbleton examines finished casting with Cleaning Room Foreman Cliff Raymond.

BAY STATE ABRASIVES

BAY STATE WHEELS of PROGRESS

Bay State Abrasive Products Co., Westboro, Massachusetts.
In Canada: Bay State Abrasive Products Co., (Canada) Ltd., Brantford, Ontario.
Branch Offices: Chicago, Cleveland, Detroit, Los Angeles, Pittsburgh. *Distributors:* All principal cities.

For More Information Circle 574, Page 39

only very superior

CLAY

from our own mines goes into

CEDAR HEIGHTS BONDING CLAY

CEDAR HEIGHTS AIR FLOATED CLAY

CEDAR HEIGHTS FIRE CLAY

CEDAR HEIGHTS CLAY COMPANY

50 PORTSMOUTH ROAD
OAK HILL, OHIO

Reader Information Service

Advertising content in FOUNDRY is classified by subject and listed by page number for your convenience when studying specific foundry applications. For further information on subjects advertised, refer to advertisement on the page indicated and circle Item Number on Reader Service Card—Page 39

SUBJECT INDEX

Abrasives (shot and grit) 33, 153, 191 194, 196
Abrasive belts 163
Abrasive wheels 34-35, 44, 100, 219, 221, 223
Alloying agents (ferrous metal) IFC, 5, 205
Aluminum alloy 47, 130-131, 183, 223, BC
Associations and Societies 177, 189

Belting (conveyor and power transmission) 50-51, 192
Binders (cereal) 57
Binders (oil) 122-123
Binders (resin) 2, 53, 122-123, 209, 216-217
Binders (sodium silicate) 188, 227
Bins, Hoppers, Silos, Gates 32, 159
Blast cleaning equipment 33, 149, 184
Blowers 206
Boxes (shipping, stacking, and tote) 118
Buckets 224
Burners 167

Casting machines (centrifugal) 226
Casting machines (die) 139
Chaplets, Chills, Nails 144-145
Charging machines (furnace) 244
Clay (bonding) 30-31, 36, 125, 186, 194, 199
Coke 137, 164, 195, 207, 226
Compressors (air) 55
Conveyors 32, 46, 48, 119, 176
Coreblowing machines 128, 157, 166
Coremaking machines 157
Cranes 52, 99
Crucibles and Pots 177, 190
Cupolas 244
Cutoff equipment 152

Dressers 172
Drums (magnetic) 159
Dust control equipment 151, 162, 171, 220

Electrodes and holders 58
Engineering services 42, 224, 228
Exothermic products 12, 211

Fabricators (metal) 227
Finishings (for castings) 240
Flasks and related equipment 11, 97
Flour 194, 242
Fluxes 173, 194
Furnaces (all types) 22, 54, 95, 135, 140, 167, 178-179, 188, 194, 200, 210, 229

Gases 8, 243
Graphite 113
Grinding Machines 9

Hot blast equipment 244
Hot metal carrier 146
Ingot molds 177

Ladles 180, 244
Lubricants 218

Mechanical storage racks 27
Molding machines (green sand) 108-109, 174, 197, 204
Molding machines (shell mold) 108-109
Monorails 52

Nickel 1

Ovens (all types) 106, 154, 223, 224

Parting compounds 215, IBC
Patterns and equipment 170, 224, 255
Pebbles 226
Pig iron 28-29, 137, 142-143, 156, 212
Portable tools (electric and pneumatic) 9
Pouring control systems 49
Pumps (liquid) 240
Presses 185

Radiographic equipment and supplies 242
Refractory gating components 126, 172, 193, 227
Refractory lining materials 6-7, 103, 115, 116, 194

Safety equipment 13, 56, 181
Sand 10, 45, 133, 194, 203, 240, 242
Sand control 41, 117, 226
Sand preparation equipment 14-15, 24-25, 43, 105, 117, 127, 150, 160-161, 204, 208, 226
Sand reclamation equipment 168-169
Sand slingers 105
Sand stabilizer 21, 113
Screens 226
Soda ash 225
Solenoid pilots 16
Spraying equipment 225
Stainless steel 5

Testing equipment 170
Thermocouples and Tubes 228
Trucks and Front-End loaders 99, 110-111, 136

Vents (corebox) 228
Vibrators 159

Washes (core and mold) 149

FOUNDRY

Reader Information Service

Just mail one of these cards—for more information on anything advertised in this issue . . . for further data on products described in the Equipment and Supplies section (Page 101) . . . to get copies of publications listed in the Literature for Foundrymen section (Page 155) . . . to request extra copies of editorial articles.

Index of Equipment and Supplies & Literature for Foundrymen, by Item Numbers

Equipment and Supplies Section (Page 101)

PRODUCT	ITEM NUMBER
Pneumatic Sand System	402
Aluminum Alloy Selector	403
Induction Heating and Melting	404
Carbide Saws	405
Sonic Diecasting	406
Barrel Finishing	407
Shell Mold and Core Resins	408
Ceramic Gating Components	409
Vacuum Degassing	410
Electrolytic Manganese	411
Green Sand Stabilizer	412
Electric Induction Furnaces	413
Material Handling Equipment	414
Air Cylinders	415
Recording Spectrophotometers	416
Dust and Fume Control	417
Vibratory Screens	418
Horizontal Compressors	419
Self-Sealing Couplings	420
Buckets and Grapples	421
Flask Upsets	422
Refractory Maintenance	423
Lift Truck	424

PRODUCT	ITEM NUMBER
Gas-Fired Heaters	425
Plant Safety Marking	426
Ball Casting Machine	427
Water-Cooled Welding	428
Engineering Service	429
Crane Specifications	430
Foundry Refractories	431
Carbon Sand	432
Air Scrubber	433
Cutting-Off Wheels	434
Power Tools	435
Screen Tensioners	436
Trolley Conveyors	437
Inert Atmosphere Generators	438
Dust Control Systems	439
Wire Rope Slings	440
Material Handling Equipment	441
Gas Regulators	442
Aluminum Casting Alloy	443
Blast Cleaning Machines	444
Engineering Service	445
Air Valves	446
Fan Equipment	447

Literature for Foundrymen Section (Page 155)

PRODUCT	ITEM NUMBER
Flask Truck	451
Portable Blower	452
Furnace Burner	453
Controllable Vibrators	454
Wet Blast Unit	455
Heat Reflecting Glass	456
Bin Outlet	457
Epoxy Strain Gage Cement	458
Tramp Iron Separator	459
Pressure Unit	460
Master Alloys	461
Sand Additive	462
Welding Regulators	463
Portable Elevating Table	464
Electric Vibrators	465
Sand Binder	466
Wire Rope	467
Aluminum Alloy	468
Safety Glasses	469
Hydraulic Press	470
Takeup Frames	471

PRODUCT	ITEM NUMBER
Sand Bond Compensator	472
Industrial Truck Battery	473
Disposable Sweatbands	474
Roof Ventilators	475
Dry Lubricant	476
Process Controller	477
Air Pressure Governor	478
Electric Grinder	479
Carbon Cutting Rods	480
X-ray Film Carrier	481
Vibrator Clamp	482
Moisture Controller Valve	483
Belt Splicing Kits	484
Vacuum Pump	485
Centrifugal Casting Unit	486
Air Conditioner	487
Portable Mixer	488
Portable Cobalt Unit	489
Shell Core Curing Unit	490
Swing Frame Grinder	491

FOUNDRY

OCTOBER 1961

401	431	461	491	521	551	581	611	641	671	701	731	761	791	821	851
402	432	462	492	522	552	582	612	642	672	702	732	762	792	822	852
403	433	463	493	523	553	583	613	643	673	703	733	763	793	823	853
404	434	464	494	524	554	584	614	644	674	704	734	764	794	824	854
405	435	465	495	525	555	585	615	645	675	705	735	765	795	825	855
406	436	466	496	526	556	586	616	646	676	706	736	766	796	826	856
407	437	467	497	527	557	587	617	647	677	707	737	767	797	827	857
408	438	468	498	528	558	588	618	648	678	708	738	768	798	828	858
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413	443	473	503	533	563	593	623	653	683	713	743	773	803	833	863
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428	458	488	518	548	578	608	638	668	698	728	758	788	818	848	878
429	459	489	519	549	579	609	639	669	699	729	759	789	819	849	879
430	460	490	520	550	580	610	640	670	700	730	760	790	820	850	880

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FOUNDRY

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401	431	461	491	521	551	581	611	641	671	701	731	761	791	821	851
402	432	462	492	522	552	582	612	642	672	702	732	762	792	822	852
403	433	463	493	523	553	583	613	643	673	703	733	763	793	823	853
404	434	464	494	524	554	584	614	644	674	704	734	764	794	824	854
405	435	465	495	525	555	585	615	645	675	705	735	765	795	825	855
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FIRST CLASS
Permit No. 36
CLEVELAND, OHIO

BUSINESS REPLY MAIL
No Postage Stamp Necessary if Mailed in the United States
—POSTAGE WILL BE PAID BY—

FOUNDRY
Penton Building
Cleveland 13, Ohio

Reader's Service Dept.

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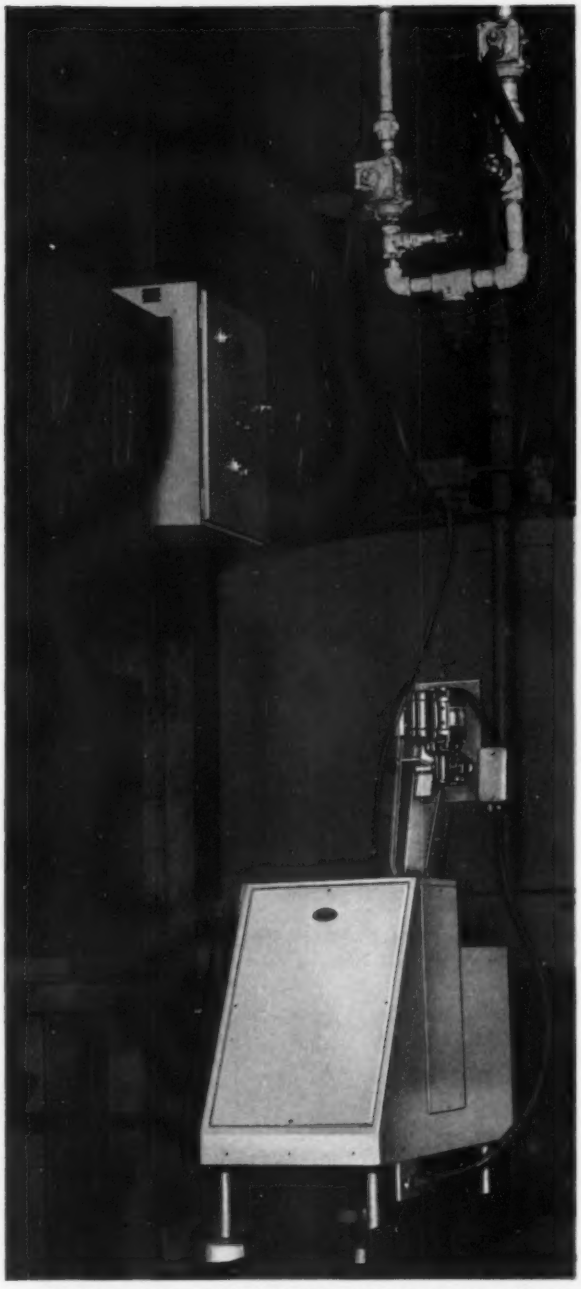


THE DIETERT-DETROIT MOLDABILITY CONTROLLER receives a small sample of sand continuously from the mixer. This is fed onto the trough of the controller. The moldability or workability of the sample is reflected in the amount of sand passing through a screen as measured by the moldability controller. Water is added only to reach the desired level of moldability. The amount of water will vary, dependent upon the changing physical properties of the sand.

Are you still struggling to control moldability with a FISTFUL of SAND?

THE MOLDABILITY CONTROLLER, by Dietert-Detroit, forever eliminates this old fistful-of-sand technique . . . *enabling every modern foundry to maintain constant moldability — hour after hour, around the clock.*

OPERATION is based on an entirely new approach to moldability control. It is simply this . . .

> **WATER ADDITIONS** to the sand are automatically adjusted to maintain a *predetermined physical property*—rather than a constant moisture level. The sand is controlled to constant moldability, *water being only one component* of the sand in process.

Since this unit controls the water addition to maintain a constant physical property rather than constant moisture, it has remarkable tolerance for variations in composition and in the amount of additives. It is designed to produce sands that will mold uniformly throughout the day, despite significant variations in the composition of the system sand, under normal plant practice.

THERE ARE NO PROBES, thermocouples, or temperature sensing bulbs in the mixer, no electronic circuits, no maintenance problems and no moisture juggling.

This new moldability control system results in a more profitable operation with much less supervision.

DIETERT DETROIT

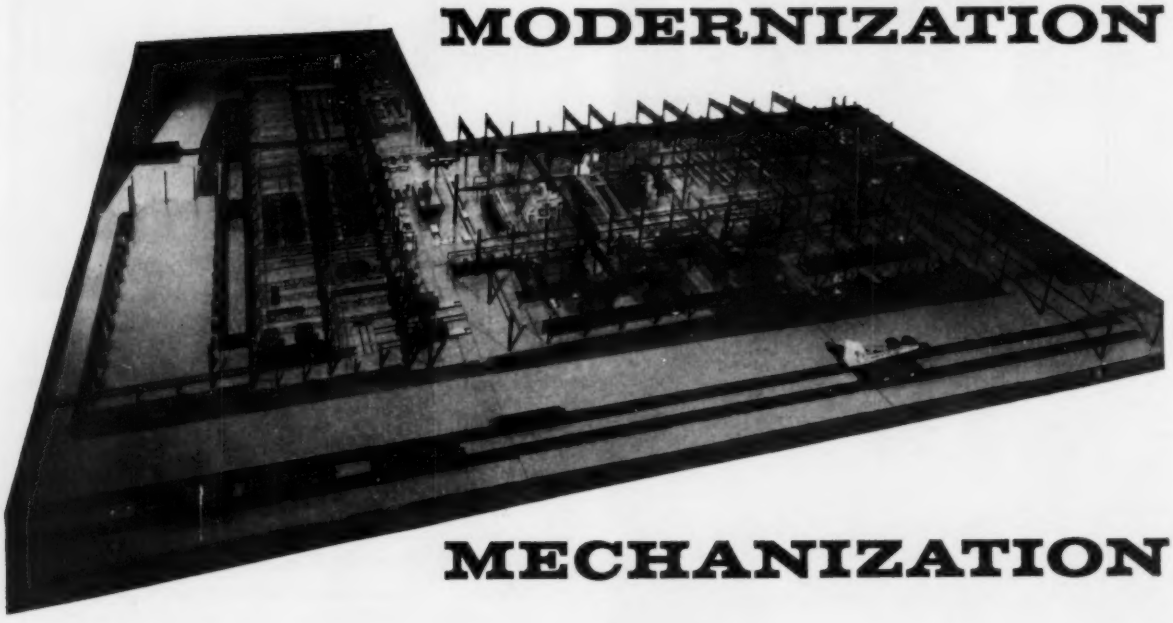
HARRY W. DIETERT CO.
9330 Roselawn • Detroit 4, Mich. • *Tel.* WE 3-9790
Send me complete details on your New Moldability Controller.

NAME_____
TITLE_____
COMPANY_____
ADDRESS_____
CITY_____ STATE_____

For More Information Circle 576, Page 39

A timely message for foundry managements

MODERNIZATION



MECHANIZATION

AUTOMATION

This model, a proposed modernization of a steel foundry producing railroad, armor and commercial castings, is an example of Knight professional foundry engineering. Operations are automated, semi-automated and mechanized to provide, insofar as is practicable, a flow of material through the plant with minimum handling, except when an operation is performed. Production per man hour has been increased, more flexibility has been provided, control of quality and delivery has been improved, plus the opportunity for lower operating costs.

This program resulted from a survey by Knight Engineers working with client personnel to determine, for this problem, the most modern technological improvements and new materials, methods and controls that could be economically justified.

KNIGHT SERVICES INCLUDE:

Foundry Engineering • Construction Management • Modernization • Mechanization • Automation • Survey of Facilities • Materials Handling • Methods • Industrial Engineering • Wage Incentives • Cost Control • Standard Costs • Flexible Budgeting • Production Control • Organization • Marketing

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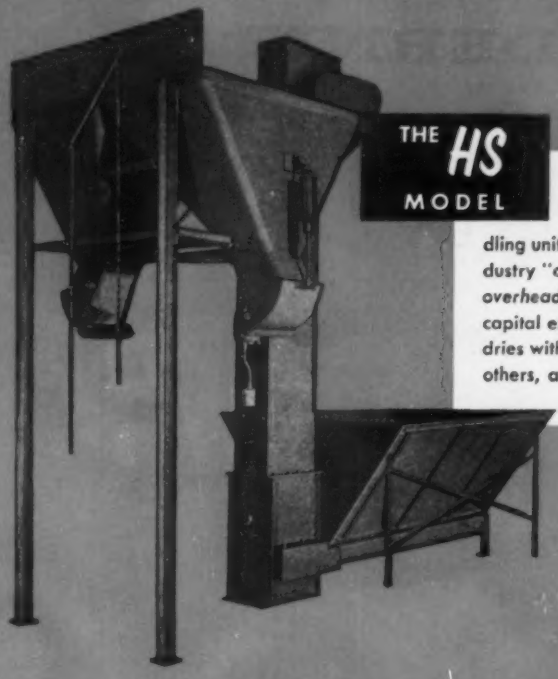
NOW! HANDY SANDY in TWO MODELS!

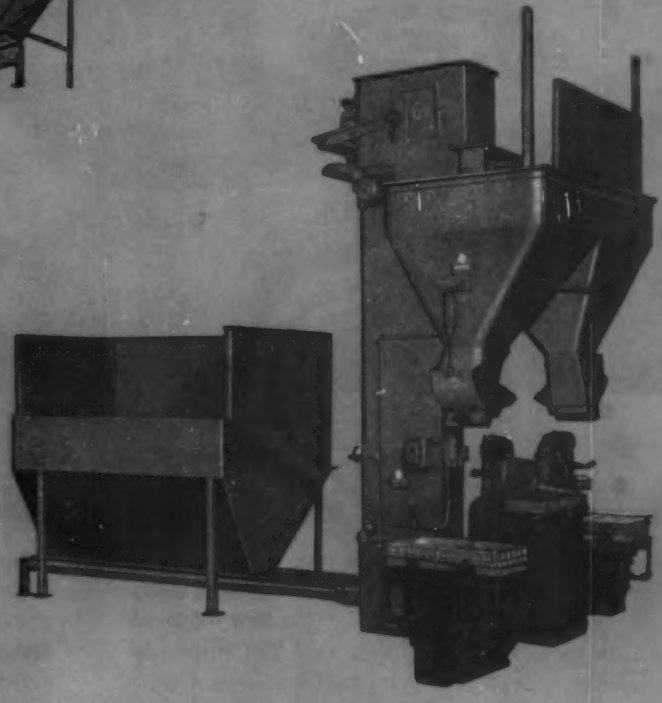
EXPANSION OF MODELS
for EXPANSION OF CAPACITY!



THE *HS* MODEL

6 TO 7 TONS OF SAND CAPACITY PER HOUR

This low-cost, individual-floor sand handling unit, enthusiastically accepted by the foundry industry *"as the most economical method for furnishing overhead sand to molding stations,"* takes a low capital expenditure to progressively mechanize foundries with HANDY SANDYS. One installation leads to others, and the savings with each one helps pay for the next HANDY SANDY.



THE *EHS* MODEL

"BIG BROTHER of the HS Model"
UP TO 20 TONS OF SAND CAPACITY PER HOUR

8-inch by 5-inch cast buckets; 10-inch wide rubber-covered elevator belt; cast head and tail pulleys; heavy duty anti-friction bearings throughout; cutting blade type of aerator with separate motor drive.

Newaygo MOVIES are yours for the asking

"PROGRESSIVE MECHANIZATION," a 16mm, 33-minute, movie shows Newaygo equipment in nine foundries. "NEWAYGO PALLET SYSTEMS FOR MOLD HANDLING," another 16mm. 25-minute movie, presents many types of Pallet Line Installations in foundries.

"Foundry Business is **BIG** BUSINESS . . ."

Write for **BULLETIN 59**

NEWAYGO engineering company
NEWAYGO, MICHIGAN

. . . and profitable, too, with NEWAYGO MOLD HANDLING, SAND HANDLING AND CONDITIONING EQUIPMENT

Also Manufacturers and Installers of MULTI-LEVEL HOPPER CONTROL SYSTEMS, CAR CONVEYORS, APRON CONVEYORS, ROTARY FEEDERS and FOUNDRY AUTOMATION

Why let long-established habit dictate your selection of grinding wheels?

Sure, the grinding wheels you've always used may be doing the job, *BUT . . . is that job good enough* in today's cost squeeze? Let Simonds help *you* update *your* grinding practices. Complete line, available through Simonds distributors, includes wheels of all abrasives and bonds, all sizes and shapes . . . all industrially-renowned products, in efficiency-proved specifications . . . and backed by our 60 year reputation as a top-rank producer of abrasive grain and grinding wheels. Send for complete descriptive catalog.

SIMONDS ABRASIVE CO.
PHILADELPHIA 37, PENNA.
DIVISION OF SIMONDS SAW AND STEEL CO.

your "buy-words" for better grinding
CALL YOUR SIMONDS DISTRIBUTOR
helping YOUR business is HIS business

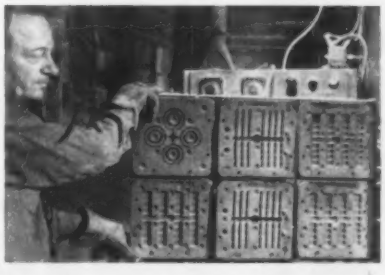
WEST COAST PLANT: EL MONTE, CALIF. — BRANCHES: CHICAGO • DETROIT • LOS ANGELES • PHILADELPHIA • PORTLAND, ORE. • SAN FRANCISCO SHREVEPORT — IN CANADA: GRINDING WHEELS DIVISION, SIMONDS CANADA SAW CO., LTD., BROCKVILLE, ONTARIO • ABRASIVE PLANT, ARVIDA, QUEBEC

CRUCIBLE STEEL SAVES THIS MUCH RESIN PER 250-LB. DRUM

...by using high-quality MC shell-molding sand.

The unique physical characteristics and screen distribution of Pennsylvania Glass Sand's MC shell-molding sand enable Crucible Steel Company of America to reduce resin content by 25% and produce higher quality castings with better finish. This superior shell-molding sand comes from the PGS deposit at Mill Creek, Oklahoma—nearly 1,500 miles from Crucible's Harrison, N. J., plant. Nevertheless, Crucible's resin savings more than offset shipping costs from Oklahoma, while MC sand helps them produce castings of top-market quality.

Supersil silica flour and 35 grades of foundry sands are available from PGS to meet any casting requirement. For full details, contact your nearest PGS office.



PENNSYLVANIA GLASS SAND CORPORATION

INDUSTRIAL SILICA DIVISION — PIONEER SILICA PRODUCTS CO.

Sales offices in New York, Pittsburgh, St. Louis and Dallas · **Plants** in Newport, N. J. · Mapleton, Pa. · McVeytown, Pa. · Utica, Pa. · Berkeley Springs, W. Va. · Dundee, Ohio · Geauga Lake, Ohio · Phalanx, Ohio · Klondike, Mo. · Pacific, Mo. · Mill Creek, Okla. · Brady, Texas.

"Our Jeffrey system permits closer control over sand mixes"

"Castings are uniformly higher in quality and appearance," reports Acheson Manufacturing Company, Rankin, Pennsylvania. "With the closer control of core and molding sands, causes of casting defects are easier to identify and correct."

Early in 1959, this company instituted the initial stage of its foundry modernization program. Jeffrey was invited in, engineering was rapid and by November the equipment was at work. A fully equipped sand laboratory was installed and sand handling was completely changed over from manual to mechanical handling.

Consult Jeffrey foundry engineers on your sand systems, mold preparation and conveying equipment, castings handling and special machines. For illustrated Catalog 911, write The Jeffrey Manufacturing Company, 907 North Fourth Street, Columbus 16, Ohio.

If it's conveyed, processed or mined, it's a job for Jeffrey.

JEFFREY

Available when and where you need it for foundry and die casting uses

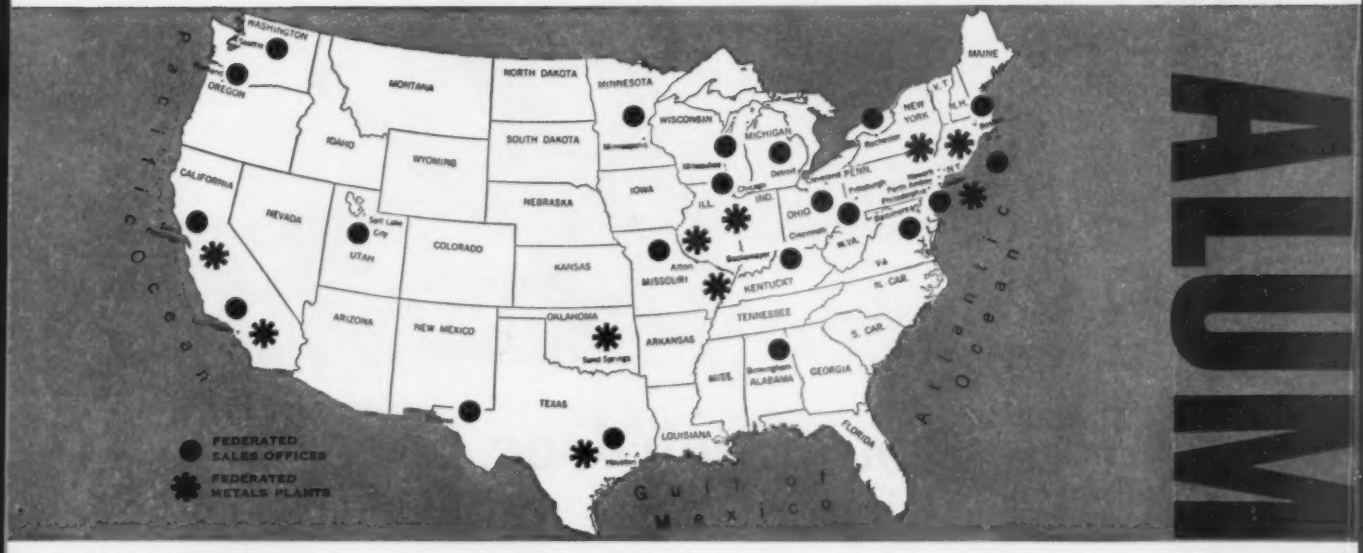
REVERE PRIMARY ALUMINUM

Revere Primary Aluminum for foundry and die casting applications is always available when you need it, in exact quality and quantity you specify. There are no time-consuming, costly delivery delays to build into your production lead-time, because . . .

Revere Primary Aluminum, in all the standard alloys, comes to you through Asarco's Federated Metals Division, which maintains a national network of strategically located sales offices and stockpoints. And offers . . .

The services of on-the-spot Field Metallurgists, who diagnose and help solve your aluminum casting problems, as well as the staff and facilities of Asarco's Central Research Laboratories

For your copy of Bulletin 195, "Revere Aluminum for the Casting Industry," write to American Smelting and Refining Company, 120 Broadway, New York 5, N. Y.



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ALTON, ILL.
Alton: Howard 5-2511
St. Louis: Jackson 4-4040

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Orleans 5-2400

BIRMINGHAM, ALA.
Fairfax 2-1802

BOSTON, MASS.
Liberty 2-0797

CHICAGO, ILL. (WHITING)
Chicago: Essex 5-5000
Whiting: Dial 659-0826

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CLEVELAND, OHIO
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DALLAS, TEXAS
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Whiting: Dial 659-0826
Chicago: Essex 5-5000

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FEDERATED METALS DIVISION

ASARCO

American Smelting and Refining Company
120 Broadway, New York 5, New York

For More Information Circle 582, Page 39

She got the job done, but...

Remember the trouble appliance manufacturers had selling women on washing clothes the easy way? At first the girls thought it was downright sinful. Actually, that same quirk of human nature can keep a foundry from modernizing, even today.

But, of course, the real crime is wasting production and earning power. And there is no better answer than having your production engineers sit down with "The Man From Logan" and analyze the *basic dynamics* of the plant. From that point he has the techniques, foundry experience, and complete equipment line to help you develop the one right conveyor system.

Your Logan *Plant Dynamation* conveyor system helps pace the foundry to its real capacity. It pays for itself fast and puts production on a better basis for years to come.

Phone or write for a visit from the Logan Plant Dynamation specialist near you. The earlier you bring him in, the more basic assistance he can offer.

Logan Plant Dynamation design helps you harness all the work-power of your plant

Logan Conveyors

LOGAN CO., 581 CABEL ST., LOUISVILLE, KY.

Foxboro makes pouring automatic!

Foxboro Control Panel for 4-spindle pipe casting machine. Low-maintenance Dynalog* Electronic Indicator (center) shows deviation from set-weight while recorder (top) charts number of pours.

Reg. U. S. Pat. Off.

custom-designed control systems help volume foundries increase production . . . produce more uniform castings . . . eliminate waste

Pipe, valve-bodies, parts — whenever you have a repetitive casting operation, a Foxboro Automatic Pouring Control System will help you do it more efficiently.

With this System you just set dials, and walk away. Instruments do the rest: weighing, pouring, sequencing — in short, making the whole pouring process automatic. Foxboro engineers will design your system, select the instrumentation, and custom-build the control panel to your requirements.

Ask your Foxboro Field Engineer for details on how Automatic Pouring Control can increase the efficiency of your foundry. Or write for complete information. The Foxboro Company, 3210 Neponset Avenue, Foxboro, Massachusetts.

FOXBORO

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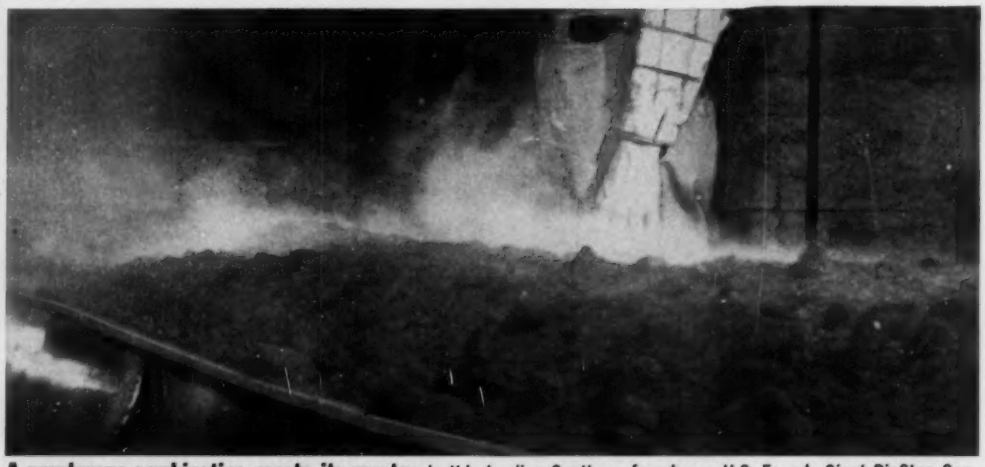
US AT THE HEART OF INDUSTRY...



A murderous combination meets its master in this leading Southern foundry as U.S. FoundryGiant RipStop Conveyor Belts withstand hot foundry sand loaded with jagged pieces of cherry-red tramp iron... last 8 times longer than other belts. Special internal wire ribs prevent jagged pieces of metal flash, sprues, gates, and other abrasive material from tearing and wrecking the belt.

CD 114

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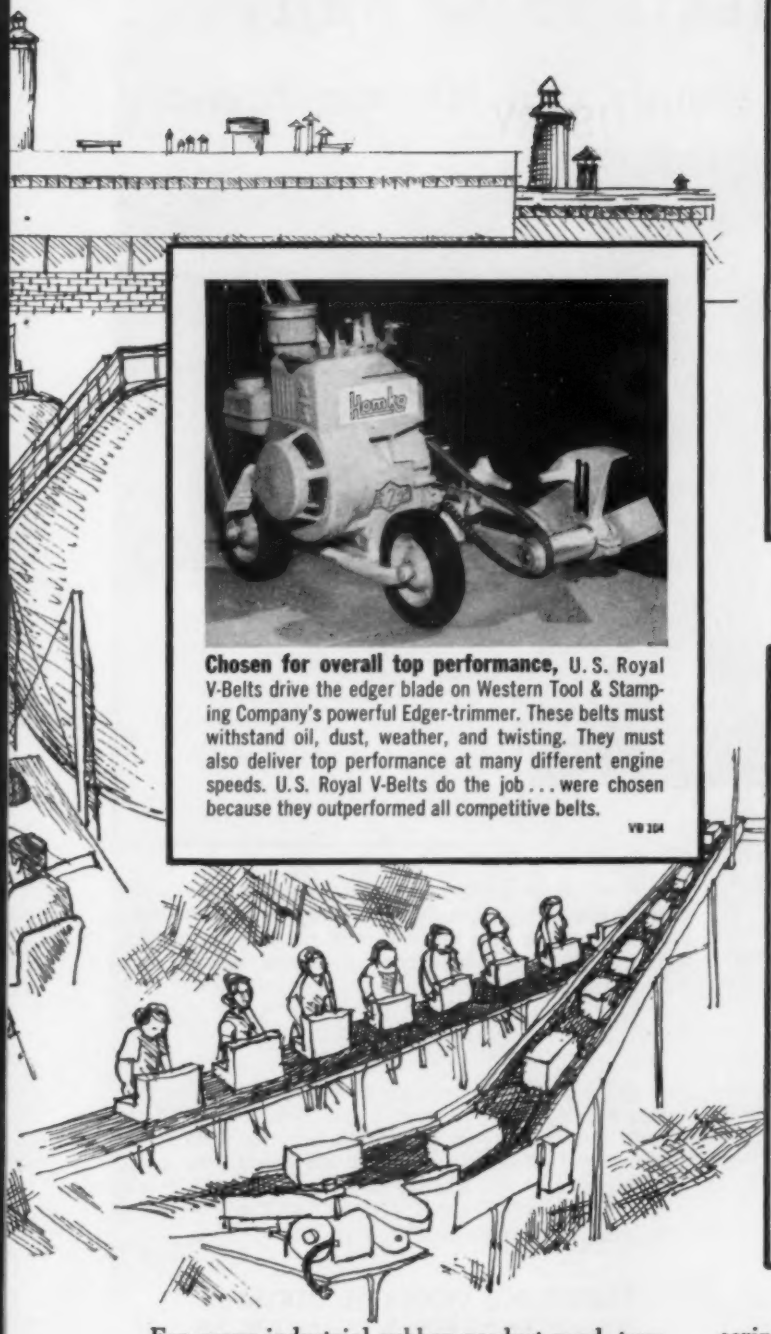

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VB 104

"On the job 3 times longer than belts previously used," says a co-owner of a Texas producer of foundry, chemical, and specialized sands about US HTB Elevator Belts. "We need belts that give long service at heats to 450°F, withstand terrific weight plus the abrasive action of sand. US Belts have never failed . . . never caused lost production or downtime."

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Globe-Union cuts downtime by 25% with US Flexible Couplings, used to couple electric motors with pumps driving molten lead up a 45° incline. Stopping and starting every two minutes, operating near equipment at 800°F, these unique couplings never need lubrication, compensate for misalignment, and cushion shocks to protect both motors and equipment.

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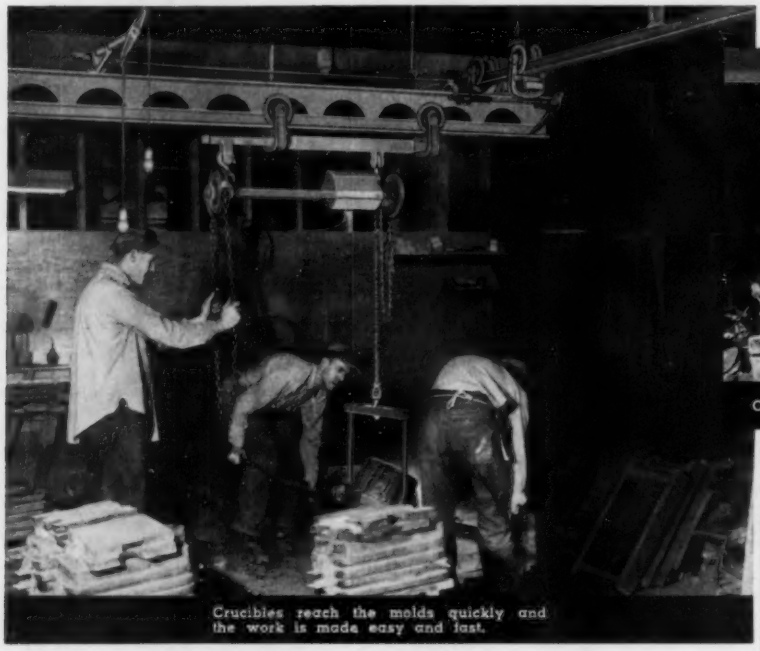
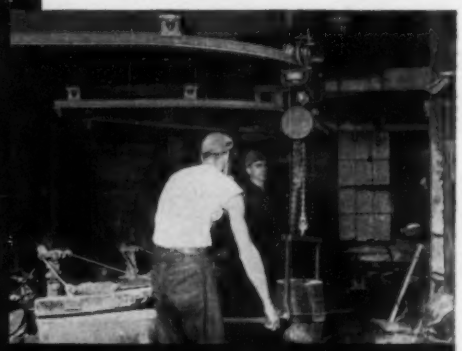
JUMPS FROM 3 HEATS TO 8 DAILY . . .

Tramrail System works wonders in 10-man foundry

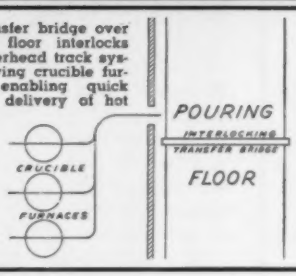


Crucibles reach the molds quickly and the work is made easy and fast.



Crucibles go direct to molds on Tramrail system.

The transfer bridge over pouring floor interlocks with overhead track system serving crucible furnaces, enabling quick efficient delivery of hot metal.



THE installation of a small inexpensive Cleveland Tramrail hand-propelled system at the Modern Brass Foundry, Columbus, Ohio, made a terrific difference in their operations. With no increase in man power, it made possible eight heats in a day instead of three, formerly usual. Despite more than double output, the men are now less fatigued at the end of a day.

No. 70 crucibles (240 lbs. capacity) are now used instead of No. 60 (200 lbs. capacity). It has been found that very little more heat is required to prepare 240 lbs. of metal than needed for 200 lbs. This provides a big saving in heat, which in itself goes a long way toward paying for the Tramrail equipment.

When they were considering installation of the overhead equipment, Modern Brass was quite concerned over a fear that it would not be fast enough and that they would be confronted with a large heat loss that would be troublesome. This fear has proven wholly unfounded. They have learned that working with Tramrail equipment is much faster than when pouring by hand.

Mr. R. E. Gleich, president, said as far as he was concerned the Cleveland Tramrail system paid for itself the first day in operation, because it so eased their work. After the first day he knew they could never afford to be without it. As a matter of fact, the equipment actually did pay for itself within a few weeks out of savings it brought about.

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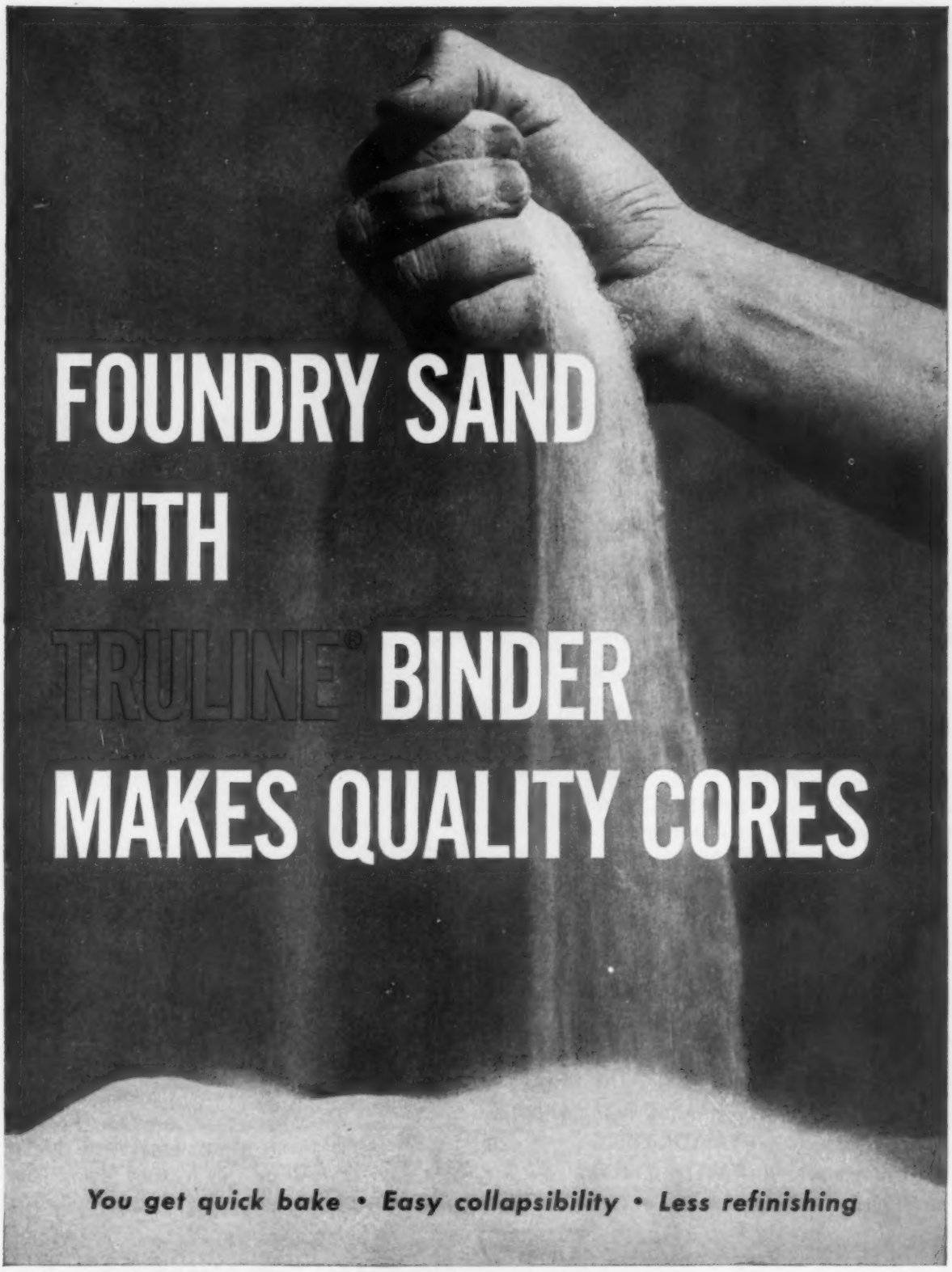

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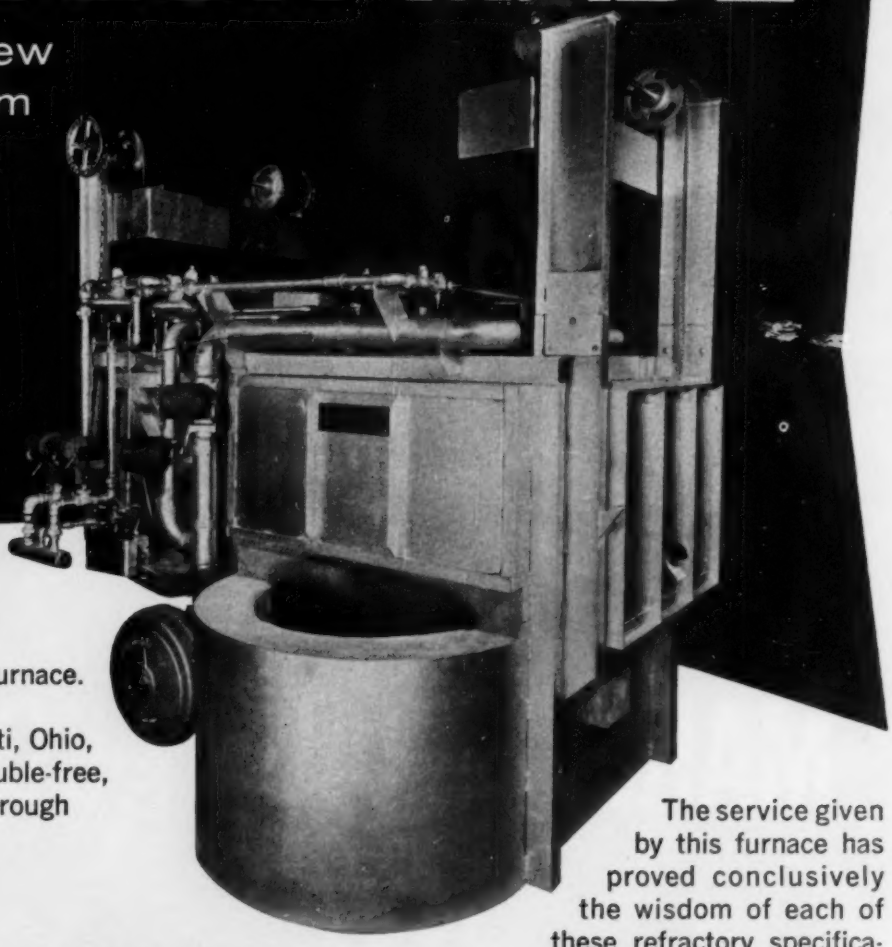

This is a new design dry hearth aluminum melting and holding furnace. Its builder, the Waltz Furnace Co., Cincinnati, Ohio, has assured long, trouble-free, economical service, through the use of these TAYLOR refractories in its construction:

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- **Holding zone walls and bottom — TAYLOR ZIRCON Brick**
- **Crown — TASIL 413 Hydrocast**
- **Dipping well bottoms — TAYLOR ZIRCON Brick**
- **Dipping well walls — TAYCO 470 Hydrocast**
- **Tap hole block — TAYLOR ZIRCON**
- **Skimmer arch — TAYLOR ZIRCON**
- **All Zircon refractories laid in TAYLOR ZIRCON 350 Cement**

The service given by this furnace has proved conclusively the wisdom of each of these refractory specifications. From a wide range of special refractories, a Chas. Taylor Sons Co. engineer can recommend a Taylor-Made product that will solve your troublesome refractory problems. Write direct, or call in the Taylor field engineer in your area.

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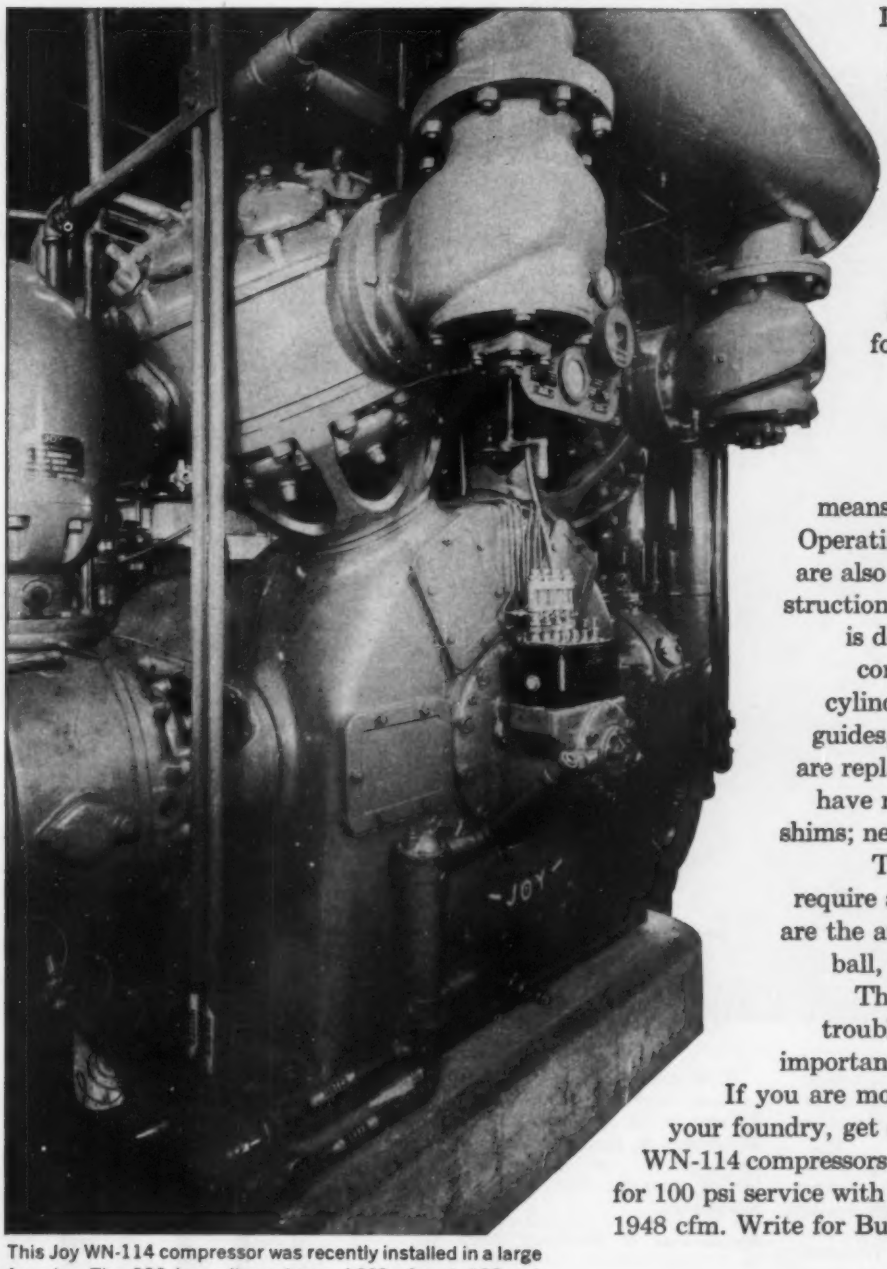
LOW COST AIR FOR FOUNDRY SERVICE—
JOY WN-114 COMPRESSORS



This Joy WN-114 compressor was recently installed in a large foundry. The 300 hp unit produces 1660 cfm at 100 psi.

If your total compressed air requirement is in the 1300 to 2000 cfm range, you can handle it with one compact machine —the Joy WN-114. The machine arrives at your plant completely assembled. You simply set it on a block foundation, bolt it down, and connect air and water lines, as this recent foundry installation was handled. This means lower installation cost. Operating costs of the WN-114 are also low because every construction feature of the WN-114 is designed for heavy-duty, continuous operation. The cylinder liners and crosshead guides, made of special alloys, are replaceable. The crossheads have no wedges, set screws or shims; never require adjustment. The main bearings never require adjustment either; they are the anti-friction, heavy-duty ball, or spherical roller type. These features mean easy, trouble free service that is so important to foundry operations. If you are modernizing or expanding your foundry, get complete details on the WN-114 compressors. There are three models for 100 psi service with capacities from 1385 to 1948 cfm. Write for Bulletin 3526-13.

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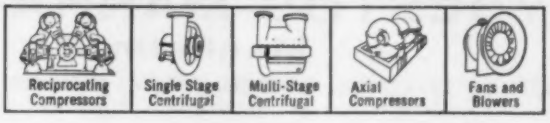

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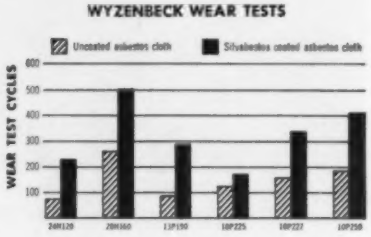
R/M makes the cloth—your safety garment supplier makes the gloves. Be sure to ask him for genuine R/M Silvabestos in gloves and other safety clothing . . . or write us for the list of manufacturers who fabricate Silvabestos.

Superior wear of Silvabestos (black bars) vs. uncoated asbestos cloths of the same grades is shown in test findings at right. *Note:* Silvabestos should not be used in contact with open flame.



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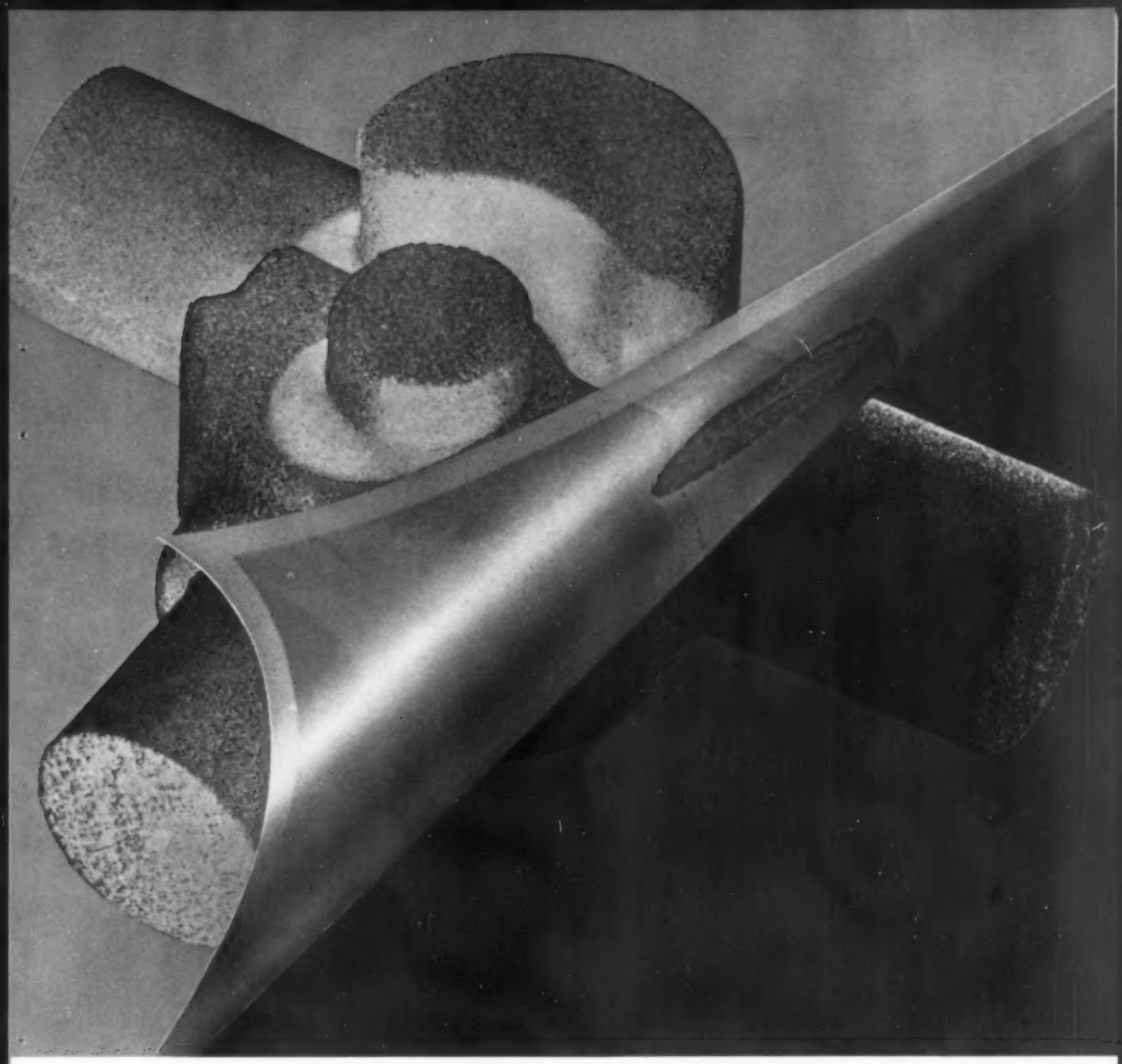

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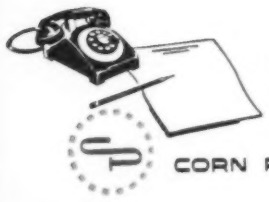

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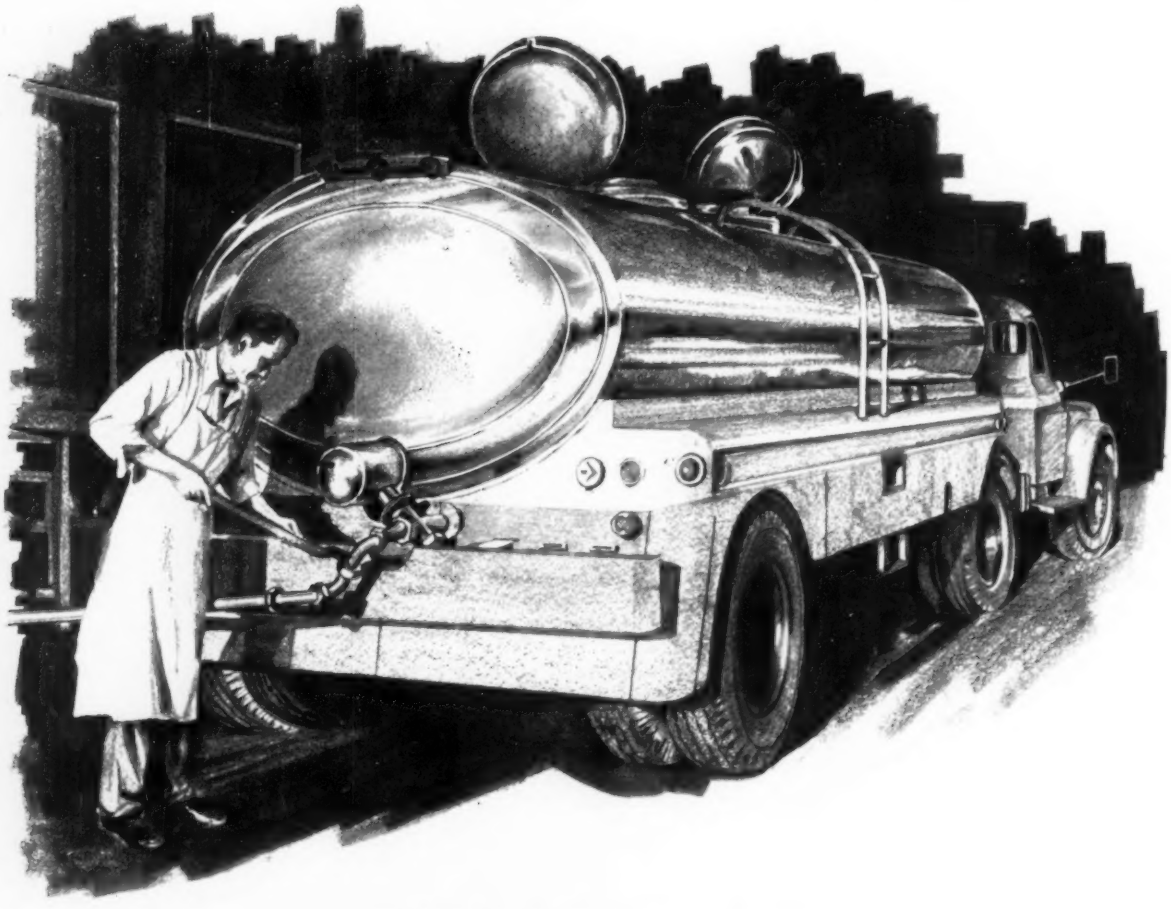

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For More Information Circle 592, Page 39

Try To Be Around!

The foundry industry has become acutely aware of the need to start marketing its castings instead of waiting for somebody to buy them. It has made considerable progress toward satisfying that need, but there are some misconceptions about how to attack the job.

In many industries, including metalcasting, there is a tendency to feel that the selling job must differ from what it is in other fields. But one authority on the subject of marketing says, "The most common pitfall of American business is to magnify—out of all proportion—the few and less significant differences, completely overlooking the basic solutions that have almost universal application."

This comment was made by A. E. Cascino, vice president, International Minerals & Chemical Corp., in addressing a Foundry Marketing Conference in Cleveland last month. Here are some of his other points:

- Every problem currently faced by the foundry industry has, at one time or another, been encountered by other industries and, in most instances, has been mastered successfully.
- The most important principle that all business entities must subscribe to—if they are to survive—is that the total organization, from janitor to president, must be truly customer conscious.
- A foundry can improve its product, but it cannot change to a different product and still be a foundry. This means that your whole marketing purpose is to improve your customer's products.
- Unless your customer recognizes certain significant advantages that you possess as a supplier of castings, he usually seeks the lowest price—or another method of fabrication.

It all adds up to this: The foundry which regards a casting as merely a casting and its sale as the result of a cut price or a personal friendship with the buyer, will lag at the end of the parade. The one which can carry on an effective marketing program backed by consistent product superiority, dependable delivery, specialized knowledge, and a real effort to help its customer improve his product, will be around when the stragglers give up.

William G. Bude

Editor

SAND SYMPOSIUM

Willis G. Lawrence

Richard W. Heine

Joseph S. Schumacher

Edward C. Zuppann

Robert J. Mulligan

A wealth of information pertaining to the use of mold and core sands is contained in the following five articles. These five papers comprised a Sand Symposium which was presented in Cleveland early this year by the Northeastern Ohio Chapter of the American Foundrymen's Society. They deal with the properties and application of various types of sands and binders, mixing techniques, and the testing and evaluation of materials.

Subjects covered in the Sand Symposium and their authors are as follows:

Page 61—Factors Influencing Molding Sand Properties by Dr. Willis G. Lawrence, Alfred University, Alfred, N. Y. Chairman of the research department, College of Ceramics, Dr. Lawrence joined the college in 1942 after five years with American Brake Shoe Co. where his work dealt with ceramic problems related to metal casting. Dr. Lawrence discusses the properties of unbonded synthetic molding sands and the differences in performance of western and southern bentonite and fireclay.

Page 68—Mixing and Molding Green Molding Sands by Prof. Richard W. Heine, University of Wisconsin. Before entering teaching in 1947, Prof. Heine was associated with Socony Vacuum Oil Co., Michigan Steel Castings Co., and General Motors Corp. In his article he discusses sand mixing and compacting techniques by various molding methods, variations in sand properties with different densities in the mold, and the effects of clay and moisture contents on mold compaction.

Page 76—Be Your Own Sand Detective by Joseph S. Schumacher, vice president, Hill & Griffith Co., Cincinnati. In charge of research, development, and engineering for his company, he was formerly a metallurgist with Cincinnati Milling Machine Co. His article explains sand testing and the evaluation of test data. It also deals with the effects of moisture on sand and its molding properties and describes the importance of some new testing procedures in relation to our knowledge of foundry sands.

Page 82—How Materials Affect Oil Bonded and Shell Cores by Edward C. Zuppann, foundry manager, Bendix Corp., St. Joseph, Mich. Previously he was with Oliver Corp., Wilson Foundry, American Steel Foundries, and United States Steel Corp. His discussion covers testing and evaluation of materials, mixing problems, and factors affecting quality. He will also explain methods of coating sand for shell cores, types of resins, and relationship of grain fineness to resin content.

Page 88—CO_2 Process and Furan Cores by Robert J. Mulligan, general sales manager, Federal Foundry Supply Div., Archer-Daniels-Midland Co., Cleveland. Formerly research chemist and research director of the company's Foundry Products Division, he was also supervisor of foundry research and development. His article covers various aspects of these newer coremaking practices, including methods of application, problems and their solution, and controls.

Factors Influencing

Molding Sand Properties

The behavior of molding sands in the green and dry states and in high-temperature environments can be explained and predicted from data based on:

The properties of clay-water systems

The packing of aggregates

The effect of heat on those two components

By DR. WILLIS G. LAWRENCE
Chairman
Department of Ceramic Research
Alfred University

● COMPOSITIONS consisting of silica sand, bentonite, and water are discussed in this article. The green, dried, and high temperature properties of such a three-component mixture depend on the properties of the aggregate, the bonding material holding the aggregate together, and the ratio of bond volume to aggregate volume.

Although one may suspect that certain properties may be determined by only one of the three components involved, the fact remains that a rammed silica sand bonded with clay is a four-phase (sand, clay, water, air) composite system whose over-all properties depend on the amount and distribution of each phase.

To develop the logical thinking and understanding necessary to explain observed test results, one must treat each phase separately or in pairs, leading up to the final complex system known as molding sand.

Bentonite[1]—Bentonite belongs to the class of disilicate minerals having a three-layer structure. The parent mineral in this group is pyrophyllite, the structure of which is shown in Fig. 1. This three-layer structure consists of a gibbsite layer $[Al(OH)_3]$ between two disilicate layers $(Si_2O_5)^{-2}$. These layers are seen easily in the perspective drawing which has been elongated in the direction of the C-axis of the mineral.

If substitution of Mg^{+2} ions for some of the Al^{+3} ions in the gibbsite layer occurs, the resulting mineral is talc. If Al^{+3} ions in this layer are replaced by Mg^{+2} and Fe^{+2}, the mineral montmorillonite (bentonite) results.

This material is characterized by its extremely small particle size. The kaolin type clays and fireclay minerals usually have particle size distributions in the 100μ to 0.1μ range (1μ = 0.001 mm) but bentonite

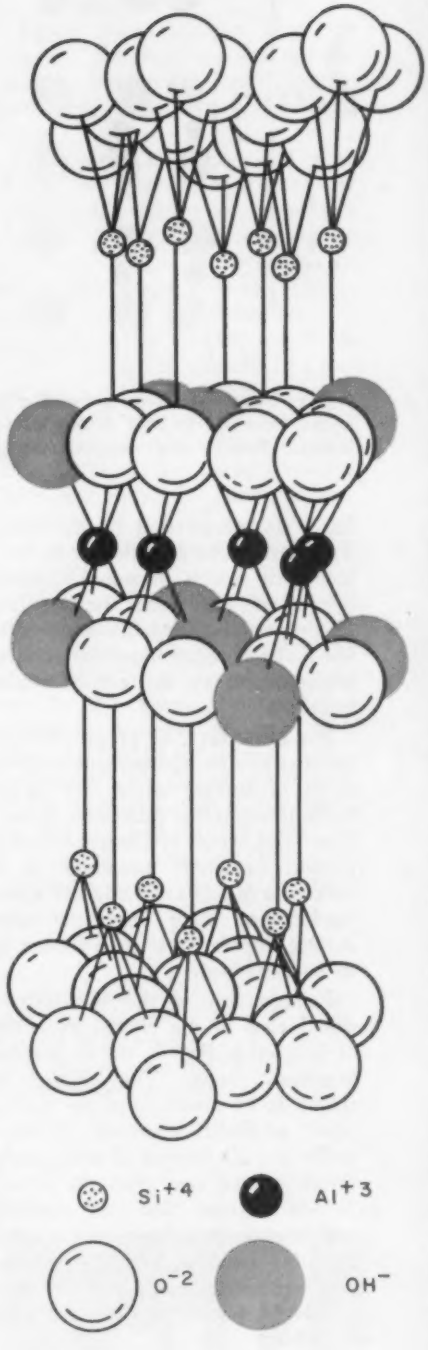


Fig. 1—Bentonite belongs to a class of disilicate minerals having a three-layer structure. The idealized structure is illustrated by this drawing

The author wishes to acknowledge the research studies of Steel Founders' Society of America in the bonding of foundry sands. Information from their research reports on "Packing of Steel Foundry Sands" and "The Development of Effective Bentonite Clay Bonds for Steel Foundry Sands" has been adapted to this paper. Also, he wishes to thank Steel Founders' Society of America and its research director, Charles W. Briggs, for their co-operation and permission to use these data.

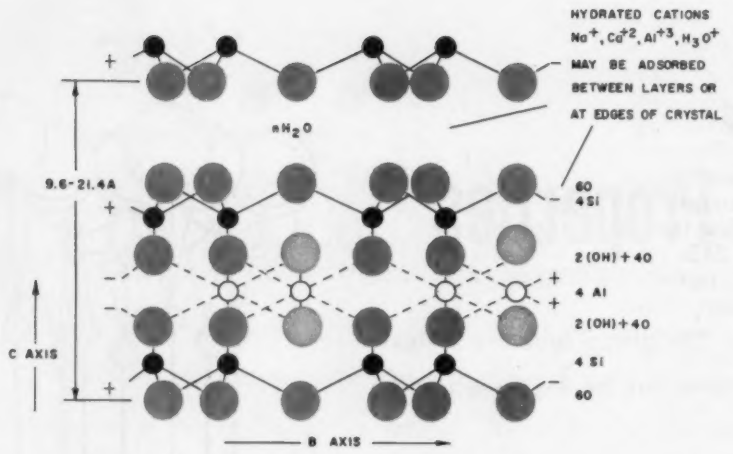


Fig. 2—Two dimensional view of a bentonite crystal shows variability of the C-axis from 9.6 to 21.4 A due to adsorption of water between oxygen layers. Positive and negative charges at crystal's edges also are shown

has a size range from 10μ to 0.01μ. Translating this particle size to surface area results in some startling figures and emphasizes the fact that the properties of bentonite-water systems will be determined by surface phenomenon at the particle-water interface.

For example, 2.61 grams of bentonite contains approximately 6000 sq ft of surface while 100 lb of bentonite contains 2400 acres of surface. The extent of the surface area present in small quantities of a bentonite makes knowledge of some fundamental facts regarding this surface imperative if its behavior is to be explained.

Examination of the two-dimensional view of the crystal structure of bentonite, Fig. 2, shows several important facts. The crystal is shown to be made up of the three-layer, sandwich structure. A bentonite particle consists of many such layers stacked one upon the other. It can be seen that the bonding within each three-layer unit is complete but bonding between the oxygen layer of one unit and the oxygen layer starting the adjacent unit is lacking.

As a result a plane of weakness exists at this point and the crystal easily is broken down into thin plates by cleavage along this inter-oxygen plane. Water molecules also can be adsorbed between these oxygen layers, forcing these layers apart and resulting in the swelling observed in bentonites. This explains the variable dimensions indicated in the C-axis of the mineral.

Examination of the crystal surface shows that the surface parallel to the C-axis is composed of positive and negative ions which are not completely co-ordinated. This results in localized areas of positive and negative charge. The substitution of Mg^{+2} and Fe^{+2} for Al^{+3} previously discussed, results in a net negative charge in localized areas within the crystal.

The net result of the surface character plus the tremendous surface area present, is that when such a mineral is placed on water surface, adsorption of water molecules and various types of anions and cations takes place.

Bentonite-Water Systems — The type or types of ions or molecules which such a surface adsorbs has a pronounced effect on the properties exhibited by a clay-water system. It has been shown that the amount of ions adsorbed is a linear function of the surface area of the clay mineral.

A well known fact illustrating the effect of the type of ion adsorbed on the particle surface is shown by the difference in swelling characteristics between western and southern bentonites. The western bentonites were deposited by nature in waters high in sodium ion content while the southern varieties were deposited in waters high in calcium. As a result of this difference, the western type has adsorbed on its surface the monovalent Na^+ ion while the Ca^{+2} divalent ion is the predominant ion associated with the southern variety.

In the case of the western type, the Na^+ ion adsorbed between the adjacent oxygen layers, Fig. 2, results in some bonding between these layers. A similar bonding occurs in the case of the Ca^{+2} ion. The fact that the Na^+ ion is larger than the Ca^{+2} and carries only a $+1$ charge as compared to a $+2$ charge results in a bond much weaker than that resulting from the Ca^{+2} ion. This is the basic reasoning behind the fact that sodium bentonites will swell more than calcium bentonites. If the ion adsorbed on the particle surface has sufficient bond strength to prevent the penetration of water molecules between layers, then no swelling can take place.

One would expect swelling to decrease as the adsorbed ion changed from Na^+ to Ca^{+2} to Al^{+3}. This is due to the increase in charge and decrease in size of the ions which results in stronger bonding between adjacent oxygen layers. Although one type of ion may predominate,

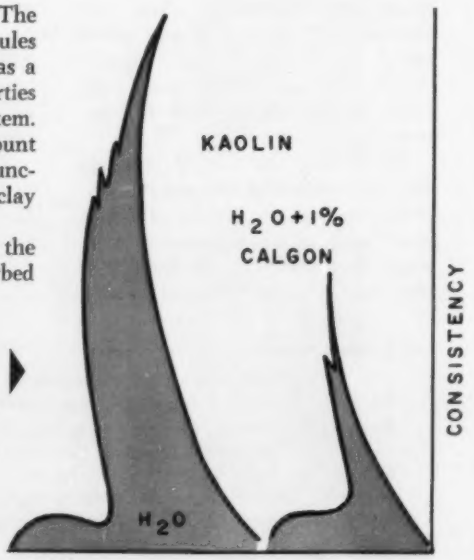


Fig. 3—Graph compares consistency (plasticity) of kaolin mixed with plain water and with water containing Na^+ ions from adding 1 per cent Calgon

nature has made very few raw materials in a pure form. As a result, all sodium bentonites contain some calcium and vice versa.

Effect of Swelling—The fact that a bentonite swells, although interesting, is in itself not a necessary requirement for foundry use. It is important to examine what happens during the swelling operation. As water penetrates between layers the C-axis dimension of the mineral expands, resulting in the exposure of more and more surface to the surrounding liquid medium. As these layers become separated to larger and larger distances any bonding forces between them approach zero.

The result is a breakdown of initial aggregates into individual crystallites of extremely small particle size. This becomes an important consideration in later discussions of properties. The fact that calcium bentonites do not swell as much indicates that the breakdown of aggregates is incomplete; such systems have less surface area and have lower bonding power than the sodium variety.

The process of swelling requires time. Studies of the viscosity characteristics of clay-water systems, show that continuous agitation over a 24-hr period is required to reach a reproducible viscosity measurement. Since the swelling process is responsible for the aggregate breakdown and the increase in available surface area, the efficiency of mixing methods involving the blending of dry bentonite with sand, then adding water and mixing for 10-15 minutes, is seriously questioned.

Plasticity Effect—Plasticity is that property of a material which permits deformation under application of an external force, with the deformed shape being retained when the force is removed. This is the property exhibited by clay-water systems which is of greatest interest to the foundrymen.

When water is added to a clay mineral, plastic properties are developed. Factors involved in the development of plasticity are reviewed below.[2]

The water initially added to a clay is adsorbed on its surface and rigidly held. This occurs because of the electrical charge present on the particle surface and because the water molecule is a dipole. Consequently, water molecules may be adsorbed on the surface and firmly held in place. This results in a water layer having a rigid structure being built up around each bentonite particle and extending some distance from the particle surface. The thickness of this layer has been estimated to be 50-100A, although accurate measurements are difficult to obtain.

The extent or development of this water layer having a higher viscosity than ordinary water is influenced by the types of ions present in the water. Bingham[3] has published data on the ionic elevations of fluidity for several cations and anions. A simplified summary of his findings is that as the charge on the ion increases and size decreases the fluidity of the water surrounding the ion is decreased

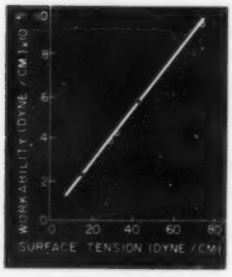


Fig. 4—Plot shows effect of surface tension of water on workability of a clay-water system (Kingery and Francl[5])

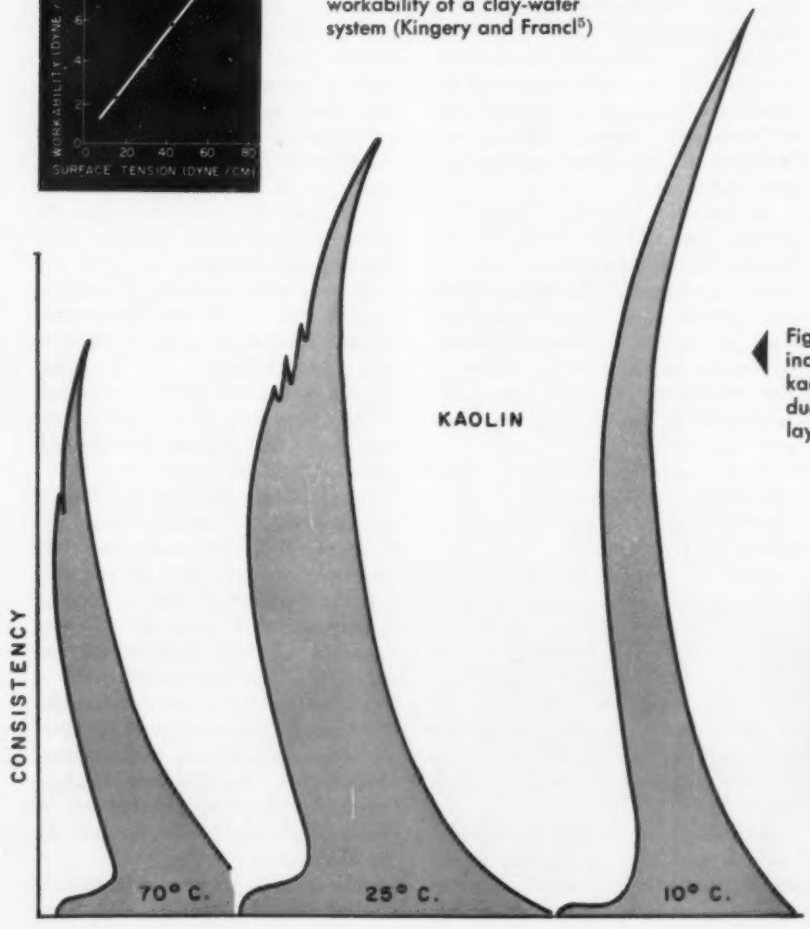


Fig. 5—As temperature increases, the consistency of a kaolin-water system drops due to a thinner rigid water layer around each clay particle

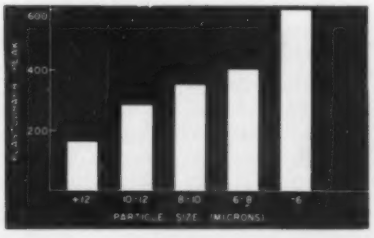


Fig. 6—Smaller particles of kaolin in a mixture of kaolin and water exhibit greater plastic properties on this graph

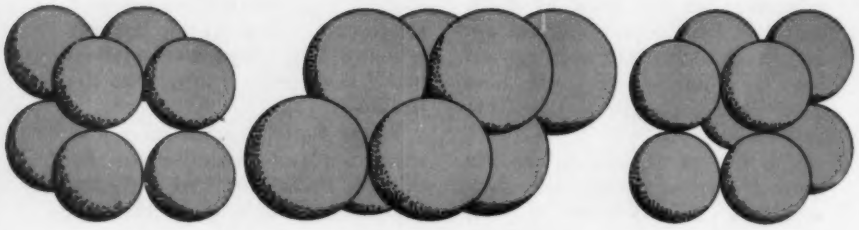


Fig. 7—The two types of packing for uniformly-shaped spheres are simple cubic, left, and simple rhombic, right

Fig. 8—Spheres from two adjacent screens are shown in a body centered cubic packing

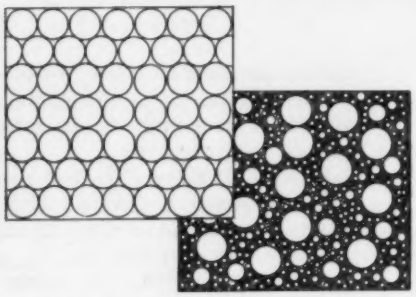


Fig. 9—Packing of a single screen sand, left, is compared with that of a five-screen sand

(rigidity increased). Those ions which promote the development of structure in the water are the ones which also improve plasticity in clay-water systems.

For example, it is well known that clay-water systems containing the monovalent ions such as K^+, Na^+, Cs^+, and Li^+ have no yield points. Regardless of the water content, they will deform under their own weight and possess no plastic properties. If, however, one changes the ion associated with the clay-water system to Ca^{+2}, Al^{+3}, or H_3O^+ the plastic properties are increased.

Effect of Charge — The mechanism of development of a negative charge on clay particles in water solutions has been discussed by Lawrence.[4] It is a well known fact that clay suspensions which have monovalent cations adsorbed on their surface have a negative charge. Such particles when placed in an electric field will migrate to the positive pole. The fact that all particles in such a suspension are similarly charged results in mutual repulsion between particles.

Such suspensions are stable since the particles will not coalesce, form aggregates, and settle out. The divalent, trivalent and H_3O^+ ions produce little or no charge on particles. Such systems are not stable, particles do not repel each other, thus agglomeration and settling result.

Since plasticity depends on the formation of a cohesive body, any forces of repulsion between particles will be in opposition to the desired effect and those systems showing highest plasticity will be those having the lowest charge on the particles. The effect of the Na^+ ion in reducing plasticity is illustrated in Fig. 3.

Kingery and Francl[5] have shown, Fig. 4, that as the surface tension of the water is lowered by surface tension reducing agents, the workability of the clay-water system is decreased in a linear fashion. The effect of the cations and anions in the surface tension reducing agents used on the previously discussed variables of charge and structure, was not evaluated.

Temperature Effect—As temperature increases in the clay-water system one would expect a decrease in the ordered structure of the water immediately surrounding the clay particles and a decrease in the thickness of the rigid water layer. The ratio of the volume of rigid water to ordinary water would be decreased. This would result in a decrease in the stress necessary to cause movement in the system and a decrease in plasticity. This effect is illustrated for a kaolin-water system in Fig. 5.

As particle size of the clay decreases, the size of capillaries between particles decreases. The capillary pressure which tends to hold the particles together is equal to $2\gamma/r$ where γ is the surface tension of the liquid and r is the radius of the capillary. Since r decreases with particle size the capillary pressure increases.

Small particles having a large surface-to-weight ratio result in a system having a high rigid water-to-ordinary water ratio.

Both of these effects result in an increase in plasticity with decreasing particle size. This is illustrated for a kaolin-water system in Fig. 6. The increase in plastic properties is obvious as particle size decreases from 12 to −6 microns. Bentonites with particle sizes in the 10 to 0.01 micron range exhibit extremely high plasticity.

Molding Sand Aggregates—Although any type of aggregate possessing the necessary high temperature properties may be used as aggregate, silica sand is by far the most common. The fundamental considerations of particle packing, bonding and the observed variations in green and elevated temperature properties can be applied to all types of aggregates.

The packing of aggregates is determined by the particle size distribution of the grain. Assuming spherical grain, one can easily determine the manner in which one, two, and three-component systems pack and the per cent void volume present.

Starting with a single component system (all grains the same size), two packing arrangements are possible as shown in Fig. 7. The simple cubic packing results in a void space of 48 per cent, while the rhombic packing results in a void space of 26 per cent. In practice a mixture of these two types of packing is achieved with a void space of 38 per cent.

If one adds a properly selected second size to the one-component system so that it fits into the void space between grains, as illustrated in Fig. 8, the void space is reduced. Thirty per cent by weight of the small size will reduce the void volume to 25-30 per cent.

If a still smaller size is added, a three-component system results. A mixture of 55 per cent coarse, 10 per cent medium, and 35 per cent fines will have a void volume of approximately 20 per cent.

Based on these simple considerations one can understand why a sand having a narrow size distribution has a higher void volume (lower density) than one with a broad distribution. The packing arrangement will have a pronounced influence on the properties of the bonded sand.

The most important variables controlled by the particle size and

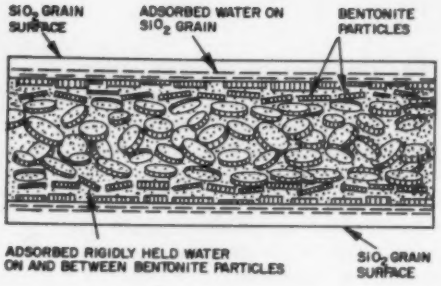

SiO_2 GRAIN SURFACE
ADSORBED WATER ON SiO_2 GRAIN
BENTONITE PARTICLES
ADSORBED RIGIDLY HELD WATER ON AND BETWEEN BENTONITE PARTICLES
SiO_2 GRAIN SURFACE

Fig. 10—Idealized representation shows bentonite-water bond between sand grain surfaces

packing arrangement are void volume and size, the presence of slip planes, and thickness of the bond layer.

As previously discussed, the void volume is decreased by broadening the size distribution of the aggregate. The size and number of voids or pores present between grains has a pronounced influence on the flow of heat (thermal diffusivity) of the sand mold. A fine sand having a large number of small pores will have a much lower thermal diffusivity than one having a smaller number of large pores.

Since air permeability is dependent on the size of the interconnected voids in the system a broad size distribution or a fine sand would result in low permeability.

Fig. 9 represents a hypothetical packing arrangement for a coarse one-component sand and a five-screen sand. The one-component packing shows planes along which slip easily can take place. Such slip planes are absent in the five-component system. The presence or absence of such slip planes will have an effect on the strength and deformation of a bonded sand.

The thickness of the bond layer (bentonite-water) will be determined by the clay content and surface area of the aggregate. Assuming constant clay content, the greater the surface area of the aggregate (smaller the particle size) the thinner will be the clay-water coating on each grain. The thinner the coating, provided it is continuous around each grain, the stronger will be the system. Thus, fine sands are stronger than coarse sands, assuming constant clay content.

Bonded Molding Sands—Having considered the properties of clay, clay-water, and the packing of aggregates, let us look at the observed properties of some molding sands and base the explanation of their behavior on the clay-water-aggregate-void, four-component system. The clay-water layer surrounding each grain is represented by Fig. 10.

This greatly enlarged picture shows two silica grain surfaces with a layer of water adsorbed to the SiO_2 surface. The bentonite particles are represented as flat discs oriented parallel to the surfaces of the sand grains with the degree of orientation decreasing as the distance from the aggregate surface increases (thickness of bond layer increases). The physical characteristics of this layer, together with the number of such layers and their arrangement play a predominant role in sand properties.

Any measurement of mold hardness made by an instrument which penetrates a rammed sand surface involves movement of the sand grains past one another in a localized area. Hardness is a function of the strength of the bond between grains. For constant clay and water content a fine sand will reach a high mold hardness with less ramming than will a coarse sand. This is due to a thinner bond coating around each grain.

Likewise a sand which has a broad distribution of particle size and is a close-packed system will attain higher mold hardness than will a single screen sand. This is due to the initial closer packing resulting in greater contact area between grains. With continued ramming, all sands approach the same mold hardness indicating this property is a function of the intergranular bond, Fig. 11.

Green Strength—The green compressive strength of a sand is a function of the intergranular bond. Sands with the highest surface area (fine particle size) have higher strengths than do coarse sands. This is due to the thinner bond between grains and the larger number of bonding surfaces per unit volume.

Sands having a wide size distribution have higher strengths than those with a narrow size distribution due to the tighter packing arrangement, greater contact surfaces, and thinner bond layers between grains. In general, an increase in water content will decrease green compressive strength as illustrated in Fig. 12.

This property is related closely to the packing arrangement of the grain and the thickness of the bond layer between grains. Fig. 9 shows the hypothetical packing arrangement for a one-screen sand and a five-screen sand. The packing arrangement for a one-screen sand is such that slip planes exist. When stress is applied to the system, one layer of sand grains will be displaced relative to those in the adjacent layer. In a sand having a broad size distribution, no such easily definable slip planes exist, since the particle packing arrangement causes such planes to be intersected by particles of different size.

Deformation also will be influenced by the thickness of the clay-water bond between grains. A thin bond will be stronger and more brittle than a thick bond layer. Thus, at constant clay content, a coarse sand with its thicker clay-water bond will start to deform at a lower stress than a finer sand, and its de-

Fig. 11—Ramming has varying effects on mold hardnesses of different sands as shown here

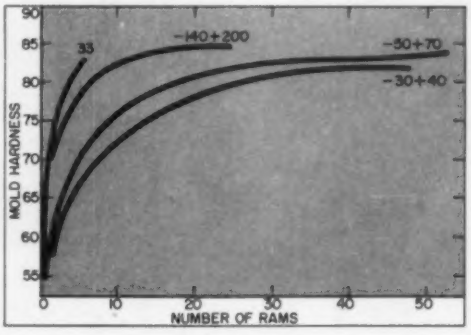
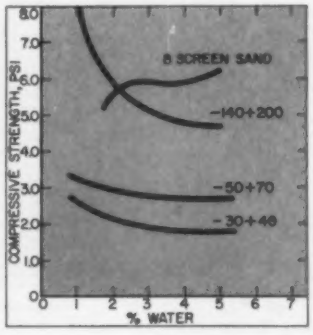


Fig. 12—Water's effect on compressive strengths of various sands is plotted for AFS samples



formation will be greater, since a thick bond coating will permit movement of grains. Any cracks which may develop will heal themselves due to the plastic nature of the bond.

A multiscreen sand has higher deformation than a single-screen sand because of the absence of slip planes and the fact that cracks can not propagate through such a system as easily. One grain can move in a localized area to relieve stress without movement of an entire plane of grains.

Hot Properties — In considering high temperature properties of bentonite-bonded silica aggregate one first must understand what happens to these materials when they are heated separately.

Silica grain which consists of α-quartz when heated is changed to β-quartz at a temperature of 1062° F. This is a rapid inversion accompanied by a large volume expansion. The thermal expansion of silica is shown in Fig. 13. The maximum expansion is a function of the thermal expansion characteristics of the aggregate.

Several reactions take place when bentonite is heated from room temperature to 1000° C (1800° F). This is shown by the thermal analysis curve in Fig. 14. The first endothermic reaction (requires heat) takes place at 180° C. This is due to removal of free water and the rigidly held water which is adsorbed on the surface of the bentonite particles. As this water is removed, the particles come in closer contact, resulting in an increase in strength.

Thus, dried strength is higher than green strength. Continued heating shows an endothermic peak at 700° C (1292° F). This is due to the loss of the chemically combined water (OH^- ions) from the crystal lattice of the bentonite structure. This results in destruction of the crystal and leaves highly charged ions such as Al^{+3} and Si^{+4} not completely co-ordinated. Since these ions can satisfy themselves by bonding with oxygen ions of the SiO_2 surface an increase in strength of the bond results.

At 900° C (1652° F) a small endothermic peak is visible. It is caused by initial melting of the bentonite. As soon as glass formation takes place one would expect a decrease in hot strength.

Immediately following the initial melting an exothermic peak at 960° C (1760° F) is observed which is due to crystallization of $\gamma - Al_2O_3$ from the melt.

Expansion Characteristics — The maximum expansion of a sand is a function of the expansion characteristics of the aggregate and of temperature. The higher the temperature, the more the maximum expansion as shown in Fig. 15. The shape of this curve is similar to the expansion curve of quartz shown in Fig. 13.

The time required to reach this maximum expansion will be a function of the rate at which heat is accepted and transferred by the sand. This is a function of the size of voids present in the material. A fine sand will have smaller void spaces than a coarse sand. A sand with a broad particle size distribution will have small voids. Since thermal diffusivity is lower for a specimen containing a large number of small voids as compared to one having a smaller number of large voids, heat will penetrate the fine grained sand slower, and it will require a longer time to reach maximum expansion.

A region of contraction follows the maximum expansion. This is due to the action of heat on the clay bond. In the case of bentonite at 700° C (1292° F) loss of the water of hydration from the crystal results in shrinkage. Shrinkage starts at a temperature of 700° C which corresponds to the loss of water of hydration from the bentonite crystal.

Hot Compressive Strength—The hot strength of a bentonite-bonded sand depends on the temperature, thickness of the bentonite layer surrounding each sand grain, and particle size distribution of the aggregate.

As temperature is raised from room temperature to 900° C an increase in strength is observed. At approximately 900° C, glass formation or melting occurs in the bentonite as shown by the differential thermal analysis curve. This results in a decrease in strength. This effect is illustrated in Fig. 16.

The thickness of the clay coating has a pronounced effect on hot compressive strength. Thus, for a constant clay content, a decrease in grain size results in a thinner and stronger intergranular bond which results in an increase in strength. Hot strength also depends on the distribution of particle sizes due to

Fig. 13—Thermal expansion characteristics for various forms of silica

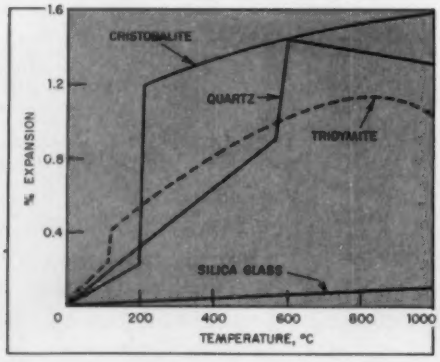
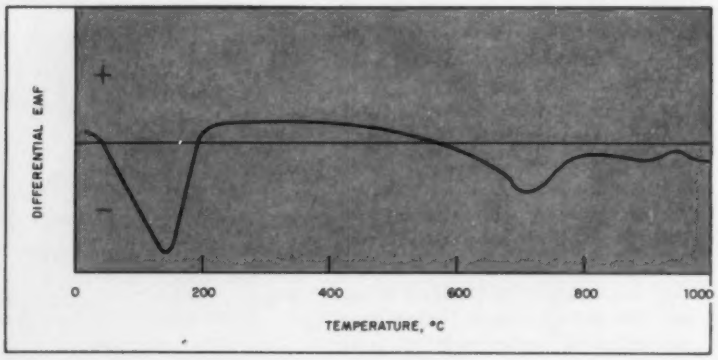


Fig. 14—Thermal analysis curve points out the various reactions which take place when bentonite is heated to 1800° F



the presence of slip planes in the single-screen sands and the absence of such planes in the multiscreen sands.

A single screen sand under load will have few contact points and a small percentage of total area in contact with other grains. When rupture occurs between a pair of grains, the crack will propagate along the slip plane until it reaches a surface where failure occurs.

A multiscreen sand with its denser packing arrangement has no obvious slip planes and a greater percentage of the grain surface is in contact with other grains. The crack propagation direction will be intersected by grains; thus, its length increases before reaching a surface. The longer the crack length, the greater the possibility of its intersecting an area of higher-than-average strength.

Hot Deformation—Based on the thermal analysis of bentonite previously discussed, one would expect low hot deformation in a bentonite-bonded sand until a temperature was reached at which some glassy phase was developed in the intergranular bond.

A typical relationship between deformation and temperature is shown in Fig. 17. This indicates that up to 900° C (1652° F) the bentonite bond remains rigid with low deformations. Above 900° C to 1100° C (1652-2012° F) the glass formation in the bond results in high deformation. The grains can flow past one another without crack development due to the viscous nature of the glass.

Above 1100° C (2012° F) deformation decreases. This probably is due to formation of crystalline products in the glassy bond by devitrification, solution of SiO_2 by the bond, or formation of crystalline products by high temperature reactions resulting in increase in rigidity of the bond.

Summary—Based on the knowledge of the behavior of the individual components alone or in combination in a four-component system (sand-bentonite-water-air) comprising a molding sand, one may explain observed behaviors.

The effect of adsorbed ions on the swelling and bonding properties has been illustrated. The variables affecting the plastic properties of clay-water systems has been reviewed to provide a basis for interpreting observed behaviors of molding sands.

The properties of molding sands, green, dry, and at high temperature, are governed by the intergranular bond, properties and surface area of the aggregate, particle size and packing, and number and size of void space.

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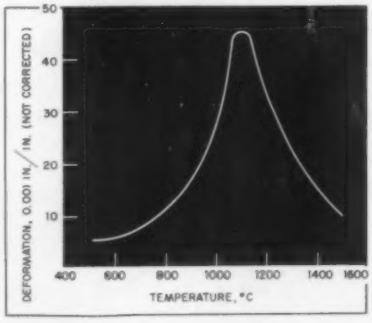


Fig. 17—This curve of temperature vs deformation is typical for a sand with 3 per cent clay bond

Fig. 15—Curve follows temperature effect on maximum expansion of sands with 3 per cent clay

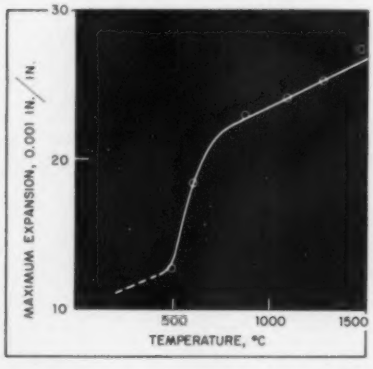
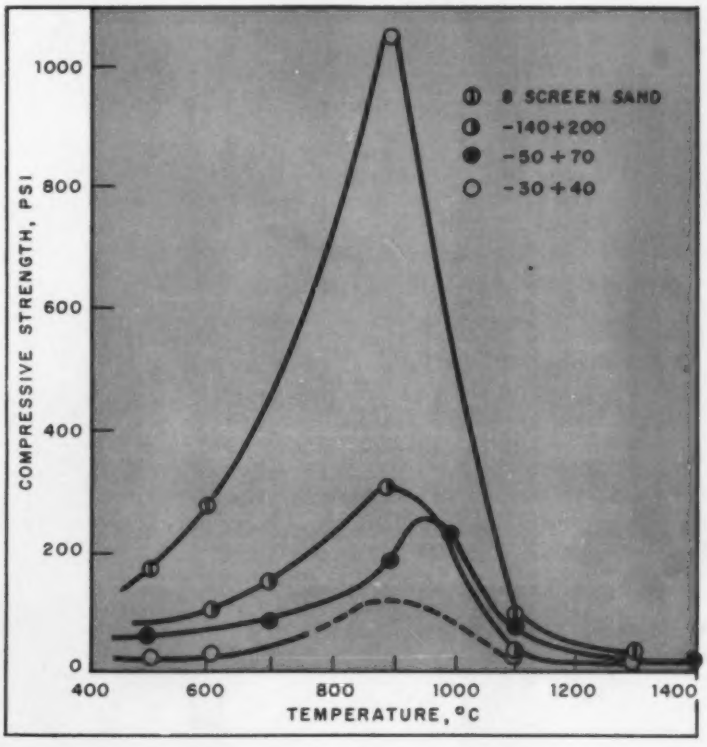


Fig. 16—Plot relates effect of temperature, grain size, and grain size distribution on hot strength of sand with 3 per cent clay



Mixing and Molding

Foundry Green Sand

Several changes occur in sand during mixing. Those changes and their effect on the behavior of molding sand during squeeze and jolt molding are described in detail

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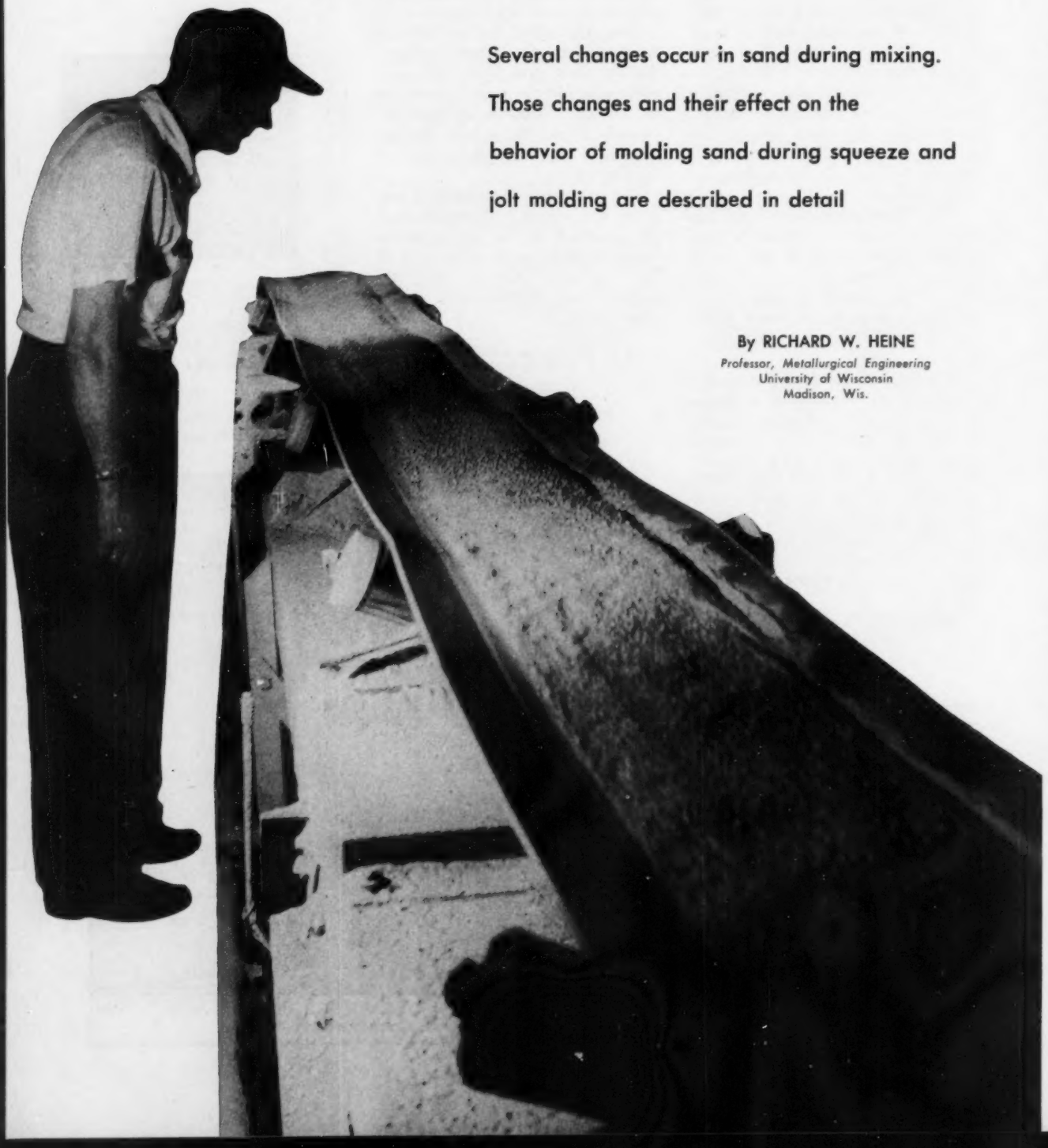


● THE MIXING of green molding sand usually is thought to be a means of uniformly dispersing the ingredients of the mixture and coating the sand grains with the binding agent and water. Actually, a number of changes occur continuously in the sand during mixing. They may influence behavior of the sand in molding.

The changes are: Agglomeration, attrition, temperature change, lumping, aeration, cumulative mixing and re-use, and progressive change in mechanical properties of the sand. Sand is mixed with a variety of equipment which may accentuate one or more of these changes.

Agglomeration — This refers to the accumulation of individual grains into clusters, which function as a larger grain. The agglomerates may be very tiny balls made up of clay or silt only; they may be larger balls made up of clay, silt, and fines; or they may be very large clusters of the complete size range of particles in the aggregate. The agglomerates may be as small as the finest particles present or as large as $\frac{1}{4}$ to $\frac{1}{2}$ in. in diam or larger, depending on the materials in the aggregate and the condition of mixing.

There are two major causes of agglomeration: 1. Excessive fines in the mix. 2. A critical moisture range.

When the ratio of number of coarse particles to fine particles of silica sand is less than about 1 in 8 to 10, insufficient coarse particles exist to disrupt the continuity of balls or clusters. They then become stable and will not be broken down by mulling. This ratio corresponds to fines in excess of 1 to 3 per cent by weight of 200, 270, and pan material in an AFS 65 to 70 sand.

The moisture range most easily causing agglomeration or balling is the adsorbed moisture level ±10 per cent. The fines and clay take on the moisture and develop green strength with continued mulling. High levels of free water cause the balls to be soft and easily broken.

Obviously, increasing moisture content ultimately would form a slurry and no balling would occur. It is when the critical moisture range and an excess of fines are present that balling is at its worst. Natural molding sands exemplify this behavior in sand mixtures.

A tumbling or rolling movement of the sand during mixing causes agglomeration to occur most rapidly. This happens most readily in an overloaded muller where much sand rides high above the path of the wheels, i.e., large batch size or muller size promotes agglomeration.

Balls are objectionable in molding because they produce a poor mold surface. Sand balls frequently have sufficient strength so that they do not compact against a pattern and, therefore, leave supervoids at the mold surface. These voids then appear as bumps or roughness on the casting surface.

Attrition — This refers to the grinding or fragmentation of sand grains and clay particles with resultant formation of finer particles. Attrition occurs by the forces of muller wheels acting on sand grains and by the grains acting on each other. Conditions which favor attrition are:

1. Small batch size in relation to muller capacity and consequent shearing of sand grains under pressure. This effect varies with muller type.

2. A single grain size aggregate. The corners of grains are abraded and become fines. Compounded grains are broken up. Conversely, an excess of fines reduces the amount of attrition through agglomeration.

3. High applied pressures in the mixing or mulling equipment.

Attrition causes a gradual increase in sand grain surface area to be coated by water. Hence there appears to be a gradual drying of the sand at constant per cent moisture when sand is mulled for long periods. An accompanying increase in green strengths occurs.

Temperature Change—Temperature may increase or decrease during mixing of green sand. If hot return sand is charged into the mixer, moisture is evaporated rapidly so that effective mixing is prevented until the sand is cooled below 160° F. Furthermore, preventing moisture condensation on patterns and sticking sand grains, and obtaining consistent properties requires cooling of the sand below 120° F. Short mulling time aggravates the hot sand problem.

Excessive mixing in any muller may cause sand temperatures to rise above atmospheric temperature. The amount of rise depends on mixing time and intensity and on any cooling which may be applied to the mixer. Minimum molding and casting problems occur when sand is delivered for molding at under 90° F.

Excessive sand temperature during molding causes numerous problems. Drying of the sand during handling results in crumbly mold edges, sand rain from cope surfaces,

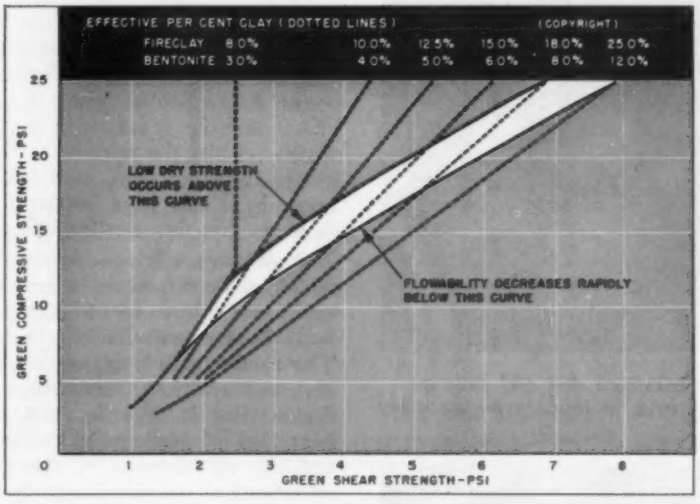


Fig. 1—Combination of green compressive and shear strengths to be expected from sands containing 3 to 12 per cent bentonite. The combinations in the white area are suggested for control purposes

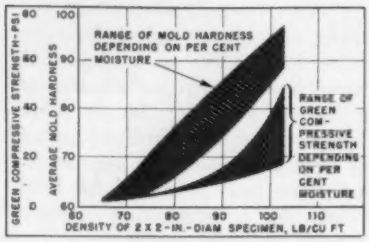

GREEN COMPRESSIVE STRENGTH-PSI
AVERAGE MOLD HARDNESS
RANGE OF MOLD HARDNESS DEPENDING ON PER CENT MOISTURE
RANGE OF GREEN COMPRESSIVE STRENGTH DEPENDING ON PER CENT MOISTURE
DENSITY OF 2 X 2-IN.-DIAM SPECIMEN, LB/CU FT

Fig. 2—Mold hardness and green compressive strength vary with bulk density of a green sand. This four screen sand has 6% western bentonite, 2% D-4 seacoal, and 1% carbonized cellulose

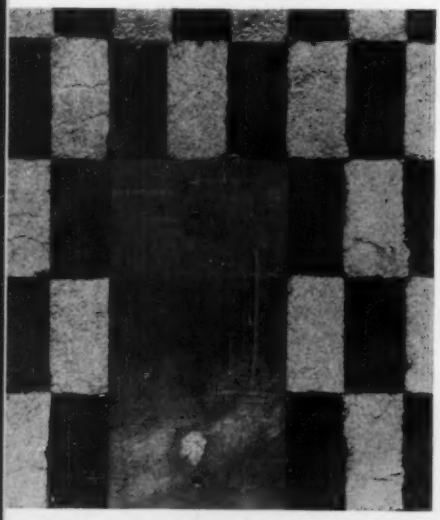


Fig. 3—Pattern and grid structure sand used in sand movement study

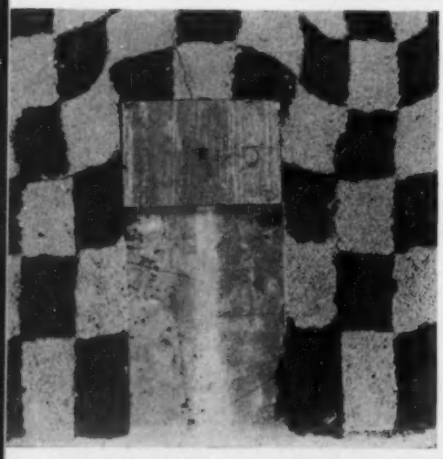


Fig. 4—How sand grid structure looks after squeezing with flat board. Pattern partly removed

Fig. 5—Mold hardness survey and density data for mold in Fig. 4

low dry strength, brittleness in pattern drawing, and a variety of other problems.

Lumping—Lumping results from pre-packing of the sand between muller wheels and the bowl. Clods are formed which must be broken to obtain a uniformly sized aggregate. Adjustment of the wheels is the remedy. Lumps are like agglomerates in their harmful effect on molds.

Aeration — Aeration consists of screening, beating, or otherwise agitating the sand during or after mixing to eliminate gross lumps coming from the mixer. Aeration fluffs the sand and is one of the effective steps used for minimizing supervoids and for producing uniform density at the mold cavity surface.

Aeration does not eliminate balling from the mixing operation but will break lumps to the size acceptable for molding. Aeration seems to produce a surface drying effect on the sand agglomerate which permits the mixture to flow freely. Riddling sand, mechanically or by hand, from hopper into flask also has this aerating effect.

Cumulative Mixing—Cumulative mixing obviously occurs in molding sands which are re-used continuously in mechanical sand systems. The results of mixing, agglomeration, and attrition accumulate to a degree that is dependent on the heat load of castings in the sand and the effectiveness of remixing operations.

Agglomerates may become hard-baked, or even calcined by heat from the castings. They may become a permanent part of the aggregate if they are not softened by the addition of water and mulling or mixing when the sand is prepared for re-use.

Green Sand Properties—From a molding viewpoint, the properties of green compressive and green shear strength are of major importance in determining response of the sand to compressive and shear forces during molding. Tensile strength, related to shear strength, is required in pattern drawing. Bulk density of the sand as mixed also is important since it determines the pounds of sand initially charged into a flask.

Initial sand bulk density at the molding operation may vary from 50 to 80 lb per cu ft, depending on mixing practice and sand type. The pounds of sand initially charged into the flask may vary by about 40 per cent, affecting the results of the entire molding process as will be pointed out later.

For consistent response to the molding process, a sand with consistent green properties must be available at the molding operation. A chart of the green properties may be used to help maintain consistency. Fig. 1 shows combinations of green compressive and green shear strengths to be expected from sands containing 3 to 12 per cent western or southern bentonites or mixtures of the two.[2] Values also are shown for sands containing 8 to 25 per cent fireclay.

The values shown are effective clay, which is clay equivalent to new clay in performance. These are the diagonal lines on the graph going from lower left toward upper right. Details of preparation of the graph are described in Reference 2. For the molding control purposes suggested here it may be recognized that mixing or mulling can alter the combination of compressive and shear strength actually existing in the sand.

Further, as free moisture content increases, compressive strength and shear strength generally decrease. This decrease follows approximately along a line on the graph for a particular effective clay content. An increase in free moisture content usually will be accompanied by a greater bulking tendency during mixing and aeration and by in-

MOLD HARDNESS SURVEY

TOP		91	92	97	98	98	95	93	
	81	86	86	94	94	95	89	89	85
	82	78	87	95	93	98	90	82	87
	68	68	53				63	73	70
	60	61	51				57	60	56
	48	46	45				54	55	60
	36	33	32				48	52	48
	30	25	28				34	40	37
	20	24	8				25	40	29
				TOP OF PATTERN					
PARTING				89	92	95			

Specimen number 53

Flat squeeze X Contour squeeze Jolt
Pattern 3 in. X 6 in.
Initial sand height 12 in. Density, lb/cu ft 50
Final sand height 8 in. Density, lb/cu ft 65
Remarks: Soft spot at pattern corners. Density nonuniform

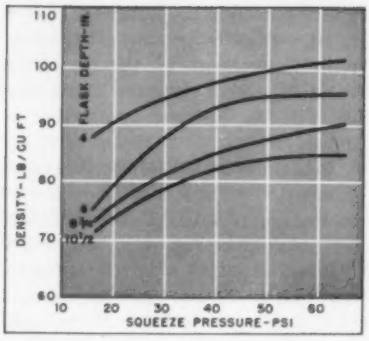


Fig. 6—Flask depth (initial sand height) and squeeze pressure affect bulk density of the sand mix

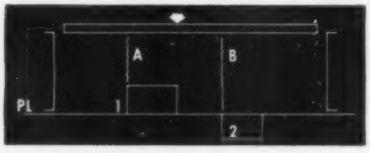


Fig. 7—Sand columns must be sheared at A and B to squeeze to parting at 1 or into pocket at 2

creased dry strength. Conversely, a decreasing free moisture content will cause higher green compressive and shear strength, lower bulking tendency, and lower dry strength.

Optimum Properties — An optimum combination of green shear and compressive strengths, bulking tendency, and dry strength at a particular effective clay content exists for molding purposes. Such combinations are indicated in the shaded area on Fig. 1. The combinations in the shaded area are suggested for control purposes although a particular foundry will need to select its own optimum. For example, some sands have better deformation below the shaded area and are so used.

Consistency of response to molding can be achieved through the use of this control method. The method also is useful for checking the uniformity of successive sand batches coming from the mixer. For example, mixed sand may be put into a second mixer for 1 to 3 minutes additional mixing.

If the properties are checked again, and a substantial change in per cent effective clay is noted, then the first mixing ended at a time-sensitive stage of mixing, indicating that the operation must be timed carefully for each batch to achieve the uniformity which is desired.

Sand is molded by compressive and shear forces. Response of the sand to molding forces is determined in part by the magnitude of forces applied by the molding machines and in part by the magnitude of resisting forces developed by the sand. Therefore, green strength properties of the sand must be controlled to produce uniform molds.

Criteria of a Good Mold—Green sand molding is a process of simultaneously moving and compacting molding sand around a pattern in a flask to develop the properties required of the sand for casting purposes. Measures of the material quality of the mold should be based on properties of the sand. Quality of the casting produced is another measure of mold quality.

Compaction increases the bulk density of the mold and also its mold hardness. Fig. 2 shows how mold hardness and green compressive strength vary with bulk density of a green sand in 2 in. diam x 2 in. specimens. The density is caused to vary by progressively increasing the ramming of the specimen from a minimum to a maximum. Bulk density, mold hardness, and green properties vary in a similar way in molds as in 2 in. diam x 2 in. specimens although molds commonly are nonuniform in density.

As far as molding is concerned, the two basic criteria of mold quality are the bulk density of the sand in the mold and the mold hardness present at the mold cavity surfaces.

Minimum and ultimate bulk densities depend on molding sand ingredients and on the manner in which they have been processed. Some examples of bulk densities of typical synthetic green sands are given in Table I. In terms of bulk density, molding success may be expressed as the percentage of ultimate density achieved. For example, when a mold is rammed to 85 lb per cu ft with a sand having ultimate density of 100 lb per cu ft, then the molding efficiency is 85 per cent.

The bulk density of a 2 in. diam x 2 in. specimen given 10 rams with the 14-lb rammer is a useful measure of maximum bulk density for a mold. The actual bulk density can be measured readily when the flask volume, sand weight, and volume of the mold cavity are known. The mold cavity volume can be determined by filling it with dry silica sand of known bulk density.

Bulk density from which molding efficiency can be calculated is a good measure of the degree to which the molding operation has approached maximum. Generally, a value of 90 to 95 per cent of the ultimate is desired to assure uniform bulk density or to avoid localized volumes of low density and soft sand.

Mold hardness is required as an additional measure of mold quality since it more accurately reflects the bulk density actually achieved at mold cavity surfaces. Hardness,

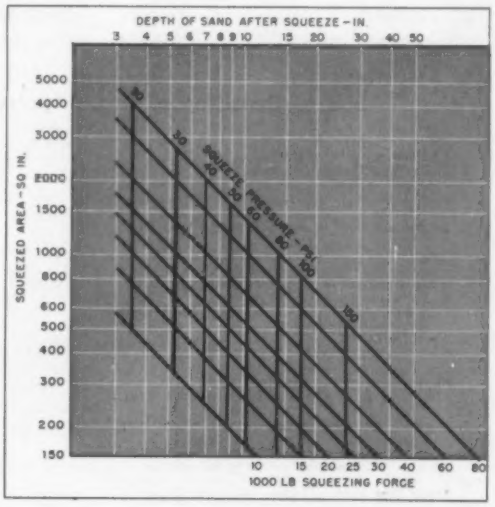


Fig. 8—Squeeze pressure needed to compact sand to bulk density equivalent to 90 mold hardness for a 6 to 8% bentonite-bonded sand

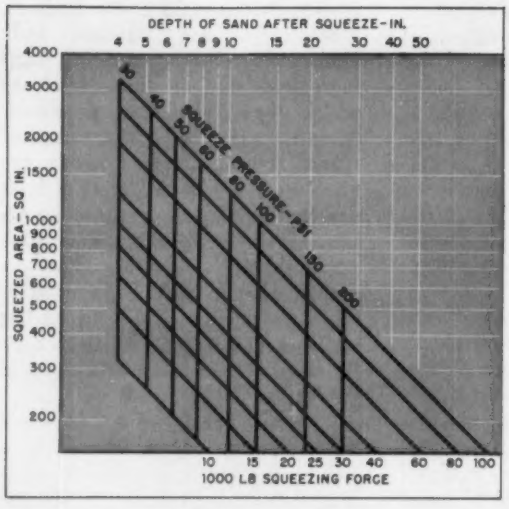


Fig. 9—The values set forth in Fig. 8 are changed when corrected for diversion of vertical force to an assumed 45-degree shear plane

particularly on vertical walls, is more sensitive to local variation of bulk density, either higher or lower, than is the average bulk density of the mold.

In addition, mold hardness is sensitive to highly localized variation in the mold cavity surface. Balls or lumps, and supervoids associated with them, cause erratic mold hardness. Naturally, casting smoothness will be influenced by continuity of the mold cavity surface or lack of it due to lumps, balls, or supervoids. Mold hardness and bulk density thus are two useful measures of mold quality.

Other qualities of the mold also are important to the casting. Molding may develop coarse porosity in the sand at pattern corners. Also, ram-offs may occur which cause the mold cavity to differ dimensionally from the pattern. Jolting may develop shear planes at pattern corners. Locked in stresses may cause difficulty in pattern drawing. Over-ramming may cause mold cracking due to spring back of flask walls or pattern.

Flask Filling — Flasks must be filled evenly because redistribution of the sand during subsequent molding does not occur. Filling generally is done by free fall from a hopper, from a prefill box, or by blowing. Each of these methods can be used to fill the flask evenly or can cause localized prepacking and higher density columns which interfere with molding. A louvered box above the flask is a common means of getting vertical fall and even distribution of sand.

Squeezing — Molds may be squeezed with a flat board, a contoured board, or a pliable diaphragm. Movement of the sand during squeezing creates problems that can limit the amount of compaction achieved. This is illustrated in Fig. 3 and 4. Fig. 3 shows a simulated section of flask and pattern surrounded with sand having a grid structure to show sand movement. After squeezing with maximum movement of the squeezing board, the grid structure appears as in Fig. 4 (pattern partially removed).

Mold hardness at the cross-section, parting, and top is as shown in the mold hardness curves, Fig. 5. Of interest in Fig. 4 is the bulged column of sand over the pattern. The sand column has approached ultimate density, and it prevents further movement of the squeeze board. In addition, the squeezing force is transmitted largely to the pattern by this sand column rather than to the sand adjacent to it.

The undeformed sand grid at the parting shows that the squeezing force has not been transmitted to the parting line. These points are emphasized in the mold hardness and density data given in Fig. 5. The average density is 85 lb per cu ft, but localized areas vary from 60 to over 95 lb per cu ft.

Another point of interest in Fig. 4 is the movement of the sand away from the upper corner of the pattern creating a porous sand volume in the mold at the corner. This usually shows as a grain finish on the corner of the casting made in such a mold.

The sand movement, mold hardness, and compaction data shown in Fig. 3, 4, and 5 were taken from Reference 3. The same method was used to study contour squeezing, jolting, and jolt-ramming. The reader is referred to the original work for details.

TABLE I—Densities of Some Typical Molding Sands

Material	Bulk Density, lb/cu ft	Per Cent Solids*	Per Cent Voids**
1. Silica sand (clay free)	100-115	60.4-69.5	39.6-30.5
2. Dry sands plus southern or western bentonite and carbonaceous additives having 9-11% AFS clay, 4-8% total combustible, 60-75 AFS fineness	90-105	54.4-63.5	45.6-36.5
3. Molding sand in No. 2 tempered with water to molding consistency			
a. Riddled	50- 65	30.2-39.2	69.8-60.8
b. Compacted to 70-85 mold hardness	65- 85	39.2-51.3	60.8-48.7
c. Compacted to 90-95 mold hardness	90-105	54.4-63.5	45.6-36.5
4. Fire-clay bonded molding sand; 12-15% AFS clay, 4-8% total combustible, 60-75 fineness; tempered with water			
a. Riddled	60- 75	36.2-45.3	63.8-54.7
b. Compacted to 60-85 mold hardness	75- 95	45.3-57.3	54.7-42.7
c. Compacted to 90-95 mold hardness	105-115	63.5-69.5	36.5-30.5

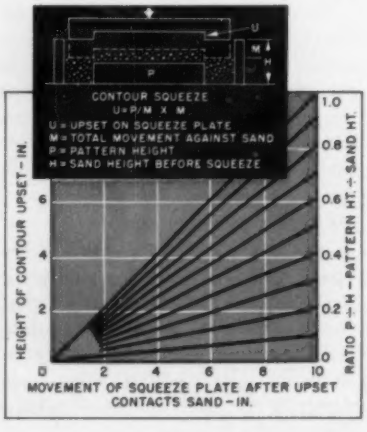
*True density of solid silica = 165.4 lb/cu ft

$$\text{Per cent solids} = \frac{\text{Bulk Density}}{\text{True Density}} \times 100;$$

$$\text{Example: } \frac{100}{165.4} \times 100 = 60.4$$

**Per Cent Voids = 100%—Per Cent Solids

Fig. 10—Theoretical squeeze plate design and relationship of contour upset height to plate movement



Squeezing Efficiency — The efficiency of squeezing is influenced by flask depth, diversion of vertical squeezing force to horizontal thrust against the flask, and the presence of sand columns over the pattern that prevent uniform application of the squeezing force to the squeezed surface. The effect of flask depth in the absence of a pattern is illustrated in Fig. 6. As the flask depth is increased, a given squeeze pressure produces a lower sand density.

This is due in part to diversion of the vertical squeezing force. It also is due in part to the fact that the green compressive strength of molding sands is about three to five times the green shear strength. Thus a vertical force, or pressure, produces compression under the squeeze board.

Deeper flasks produce lower sand density since the force to shear the column of sand under the squeeze board becomes greater than the force to compact the sand. The importance of shearing down to the parting line is illustrated simply in Fig. 7.

Flask height then affects the squeeze pressure required for shearing action to occur. Further, the green shear strength of the sand at the moment of shearing determines the shearing force required for a given flask depth. If a green sand (6 to 8 per cent bentonite) is to be squeezed to a mold hardness of 90 and corresponding green compressive and shear strengths, the squeeze pressure required as a function of flask depth and area can be calculated. Or, the relationships can be summarized graphically as in Fig. 8.

An Example—A molding machine has a squeezing force of 20,000 lb (16-in.-diam piston at 100 psi air pressure). A 20 x 20 in. flask (400 sq in.) is to be used, and a mold hardness of 90 is desired. Green compressive strength is about 19 psi; shear strength is 5.4 psi. What is the maximum flask height, cope or drag, that could be used?

In Fig. 8 locate the 20,000 lb line at lower right and follow it upward and to the left until it intersects the 400 sq in. line. Then proceed vertically from this point to the top of the graph, which gives the answer as 8.7 in.

It should be pointed out that this graph contains no correction for loss of efficiency due to diversion of vertical force to horizontal thrust against the flask walls, that the squeeze board is assumed capable of allowing shearing to take place (i.e. not rigid), and that sand columns which prevent uniform application of load are not operative. These assumptions apply only in a few cases, so the graph is very optimistic.

A correction for diversion of vertical force to a horizontal force in the flask sidewalls can be made by assuming that shearing occurs on a plane at 45 degrees to the vertical and that this shearing takes place over the full flask depth. Fig. 9 shows how this correction changes the values in Fig. 8. If Fig. 9 is used in the example above, the limiting flask depth for a full squeeze to the parting for 90 mold hardness becomes 6.2 in., compared with 8.7 in. Again, no allowance is made for build-up of a sand column, which prevents the full squeezing force from reaching the parting.

Contour Squeezing — The limiting effects of sand columns over the pattern theoretically can be offset by the use of a contoured plate. Design of the squeeze plate is predicted by formula $U = P \div H \times M$:

where: U = height of the upset or contour block added to the squeeze plate
P = pattern height
M = total movement after contact of the contour plate against the sand surface
H = sand height before squeeze

The formula is set up graphically in Fig. 10, which is used as follows: Assume a pattern height (P) of 6 in., an initial sand height (H) of 12 in., and a movement (M) of 8 in. Fig. 10 shows $P \div H = 0.50$, $M = 8$, and $U = 4$ in.

The use of a contoured squeeze plate based on this formula is shown in Fig. 11 and 12. M was found experimentally to be 8.25 in. where U was 5 in. The compaction wave, advancing ahead of the

Fig. 11—Effect of squeezing with contour blocks to compact sand along pattern sides

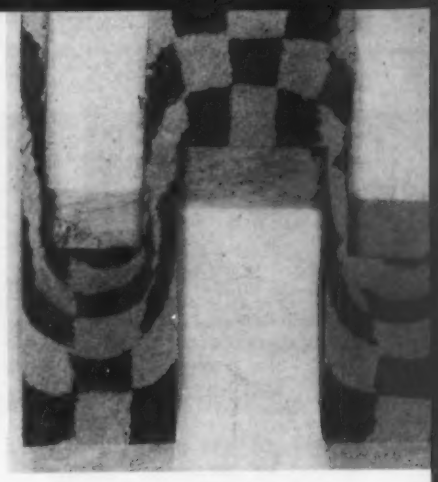


Fig. 12—Mold hardness survey and density data for mold in Fig. 11

MOLD HARDNESS SURVEY

TOP	99	99	90	92	94	93	93	99	100

91			90	92	92	94	94		57
88			90	90	93	92	92		57
77			89	92	90	93	91		65
72			79				81		70
70			76				76		73
83	95	91	97		98	89	93		92
89	93	93	96		96	90	92		93
87	91	89	97		95	89	90		87
83	86	87	97		96	83	86		83

TOP OF PATTERN

PARTING	96	94	92	98	94	97	84	90	81

Specimen number 57

Flat squeeze 3 in. Jolt Contour squeeze √
Pattern 3 in. X 6 in.
Initial sand height 12 in. Density, lb/cu ft 50
Final sand height 8¾ in. Density, lb/cu ft 80-95
Remarks: Contour squeeze plate, 2 in. X 5 in. blocks. Density nonuniform, soft spots between contour block and pattern.

Fig. 13—Specially-contoured squeeze frame compacts sand to the parting and against pattern walls

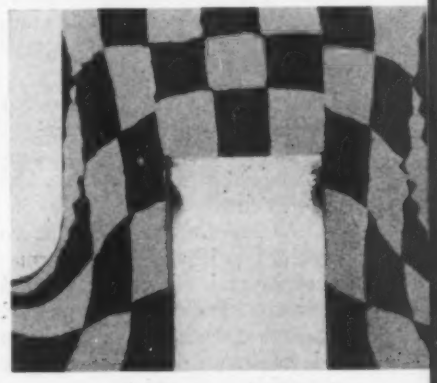


Fig. 14—Mold hardness survey and density data for mold in Fig. 13

MOLD HARDNESS SURVEY

TOP		95	98	97	98	97	98	95	

	94	97	96	98	95	97	94		
	96	94	97	95	96	94	96		
	95	94	94	95	94	93	95		
	94	94				93	92		
	98	95				92	92		
99	96	95				95	98	98	
99	96	95				96	97	99	

TOP OF PATTERN

PARTING									

Specimen number 83

Flat squeeze Contour squeeze √ Jolt
Pattern 3 in. X 4 in.
Initial sand height 10 in. Density, lb/cu ft 50
Final sand height 6¾ in. Density, lb/cu ft 95
Remarks: Contour block is 5 in. long X 1 in. wide with 1 in. radius on end. Density high and uniform.

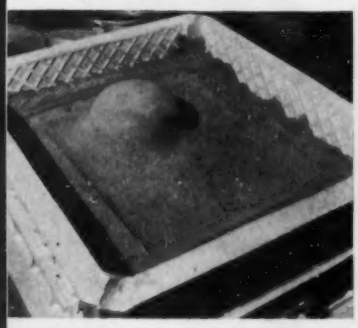


Fig. 15—Contour produced on mold surface by diaphragm squeeze

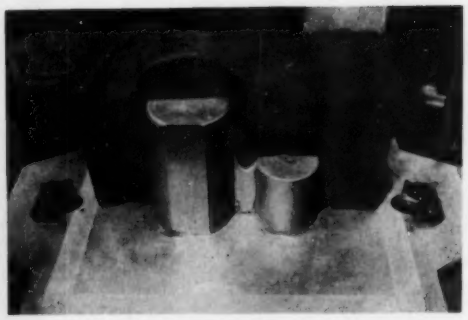


Fig. 16—Cutaway mold section, diaphragm squeezed, pattern in position

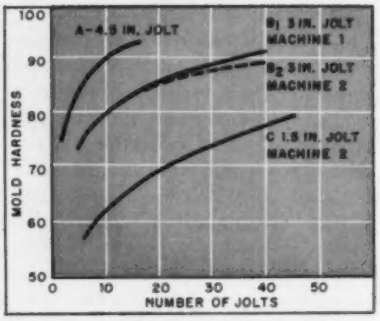


Fig. 18—Effect of number of jolts and stroke length on mold hardness

contour block, has penetrated to the parting to produce high mold hardness both at the parting and vertical side walls. Unfortunately, the thin layer of sand between the contour block and pattern is impractical.

In addition, the wedging of sand between flask and pattern locks in stresses having a horizontal component that bulges the flask walls. The development of such stresses by diversion of vertically applied load toward horizontal force components is well illustrated in Fig. 11. This problem is encountered in all uses of contour squeeze blocks, air or hydraulic diaphragms, and conventional flat squeeze boards.

Many different designs of contour squeezing frames were studied to solve this problem. Finally, contour squeezing was found to be most efficiently performed by a contour squeeze frame of the shape shown in Fig. 13 and 14. Deformation of the grid, Fig. 13, shows sand movements caused by this method of contour squeezing. Fig. 14 shows mold hardnesses produced. They are notably high and uniform running 93-96 at the pattern surface. A final density of 95 or more lb per cu ft was achieved.

The squeeze block shown in Fig. 13 must be small enough to avoid diversion of vertical squeezing force against the flask or pattern. Also, the weight of sand must be such that a column of sand is not built up over the pattern (too much sand) or under the contour block (too little sand). For rigid board contour squeezing to work ideally, the sand charged into the flask must be weighed as well as uniformly distributed. A method of cancelling out this problem is to make the contour blocks and squeeze plate self-compensating in depth of squeeze by connection to a hydraulic pressure equalizer.

Diaphragm Squeezing — Diaphragm squeezing is one attempt to overcome the limitations of a flat squeeze board. A contour squeeze is achieved partly since the pressure can be distributed uniformly. Fig. 15 and 16 shows the results of diaphragm squeezing at 60 psi squeeze pressure over an 8-in.-high pattern. The diaphragm squeeze was achieved with the device shown schematically in Fig. 17.

Squeezing with the diaphragm requires a certain minimum squeeze pressure to develop the contour. For instance, the contour shown in Fig. 16 does not develop at 40 psi; only a flat surface is obtained. This is because the pressure is not high enough to shear through the column of sand parallel and adjacent to the vertical pattern wall.

Fig. 15 and 16 also points out a problem of diaphragm squeezing. Uniformly distributed squeeze pressure is diverted against the pattern and flask walls by the sand contour itself and thus exerts a wedging effect between pattern and walls. This requires that ample room be provided between pattern and flask walls if the pattern is to be drawn normally.

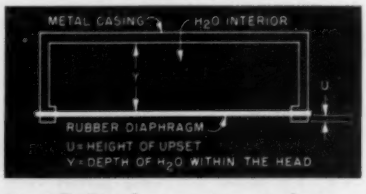


Fig. 17—Diaphragm squeeze device

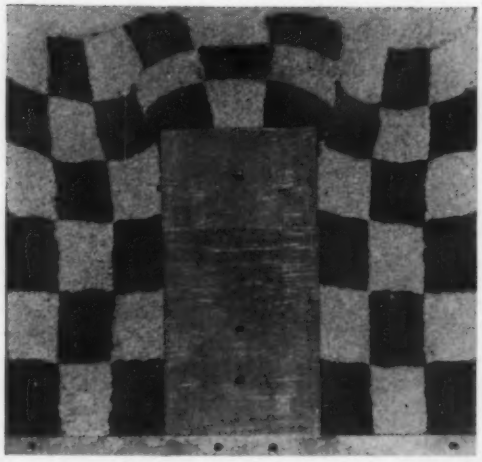
Jolting — Jolting compacts the sand through conversion of momentum of the sand to work done at the instant of jolt impact. As described in Reference 3, sand flow from jolting is similar to that from squeezing but in an inverted position. That is, sand columns build up from the parting plane and from horizontal surfaces of the pattern. References 3 and 4 may be studied for examples of this behavior. Thus maximum improvement of bulk density and mold hardness is achieved only at parting and horizontal pattern surfaces and upward for 1 to 2 in.

Machine features of importance are the jolting height and the effect of table load on jolt stroke. Fig. 18 illustrates the effect of jolt stroke on mold hardness at the parting for strokes of 1.5, 3.0, and 4.5 in. for the same molding sand. The number of jolts determines the hardness reached and the depth to which the developed hardness penetrates.

Generally, more than 20 jolts are impractical from a production viewpoint. Actually hardness penetration from the parting upward increases as jolting continues. However, the process is quite slow after the first 20 jolts and 1 to 2 in. of penetration. Jolting prepacks the sand to a higher average density before squeezing, thus minimizing squeeze movement.

Because maximum work is done at the parting and pattern horizontal surfaces, jolting contributes edge hardness at these locations. Edge hardness is difficult to obtain by squeezing alone although it is possible with perfect contour squeezing.

Squeezing and Jolting — Jolting



MOLD HARDNESS SURVEY

TOP	94	95	96	93	94	93	94	95	92
	92	92	91	95	92	94	88	90	94
	91	92	92	95	97	94	92	93	91
	91	92	90	95	93	95	90	91	90
	82	82	81	→77		76→	85	84	86
	77	77	72	→71		73→	75	81	77
	71	71	66	→66		68→	70	71	71
	60	64	60	→78		75→	57	60	63
	63	66	60	→78		77→	63	67	64
	67	59	67	→82		81→	66	67	67
				TOP OF PATTERN					
PARTING	82	85	84	93	89	93	83	82	84

Specimen number 63

Flat squeeze V Contour squeeze Jolt 20-30 in.
Pattern 3 in. X 6 in.
Initial sand height 12 in. Density, lb/cu ft 50
Final sand height 8 1/2 in. Density, lb/cu ft 60-95; 85 ave.
Remarks: Sand was added to level the surface after jolting, compare with no. 61. Density nonuniform.

Fig. 19 and 20—Deformation of test mold sand grid by jolting 20 times with a 3-in. jolt stroke, filling with sand to level, then squeezing with flat plate. Mold hardness survey and sand density data are given at right

commonly is combined with squeezing. Fig. 19 and 20 illustrate the effects of the combined actions. Both jolting and squeezing build up a column over horizontal pattern surfaces. That limits the movement of flat squeeze plates so that uniform density can not be achieved unless the flask is less than 4 to 6 in. deep.

Sand adjacent to vertical walls is low in density and hardness as shown in Fig. 20. High hardness occurs over the pattern from jolting and squeezing combined, adequate hardness develops at the parting from jolting, but the vertical wall shows softness and low density. That problem increases as pattern height increases. Soft mold walls produce the familiar casting swell.

Remedies for that situation are contour squeezing as cited earlier, molding machines with compensating squeeze blocks, hand peening alongside patterns, or removal of sand over the pattern before squeezing. Squeezing with diaphragm machines is another approach.

These methods are successful only to the degree influenced by the jolt and squeeze capacity of the equipment, flask depth, pattern height and shape, spacing of pattern from flask side walls, uniformity of filling the flask, and the type of molding sand and the bulk density at which it is charged into the flask.

To illustrate, consider molding the pattern shown in Fig. 16. The larger cylinder is 4 in. in diam by 6 in. high and it has two flat sides for vertical wall mold hardness measurements. A smaller cylinder is attached to the larger one merely to provide a pattern difficult to mold. The pattern will fit in a 12 x 14 x 10½-in.-deep flask. The various molding methods which will be considered are the flat squeeze, jolting, jolting plus flat squeeze, diaphragm squeeze using the device shown in Fig. 17, and jolting plus the diaphragm squeeze. A 12 x 14-in. flask has an area of 168 sq in.

As shown in Fig. 9, a squeeze pressure of 60 psi to 80 psi would be required to squeeze to a height of 7.8 to 10.5 in. The squeezed height after starting with a full flask was about 9 in., and this would require 65 psi squeeze pressure. Molding was then performed by the methods mentioned above. The results obtained on the flat vertical wall of the cylinder pattern are shown in Fig. 21. Average bulk density was 88 lb per cu ft by the best molding process.

The mold hardnesses shown in Fig. 21 are expected if the principles discussed earlier are fulfilled. The reasons for the vertical wall mold hardness variation by the different molding methods as shown in Fig. 21 already have been explained. The preferred mold in this problem is the one showing a mold hardness of 87-90 on the vertical walls. It was made by jolting and diaphragm squeezing. Equal or better results are obtained, however, from the rigid contour designed after the principles described in connection with Fig. 13. Of course the problem could be made more difficult or simpler by choosing a different pattern.

No discussion of the effects of variation in ingredients of the molding sand or of the effects of moisture content and sand additions on the molding process has been taken up in this discussion.

REFERENCES

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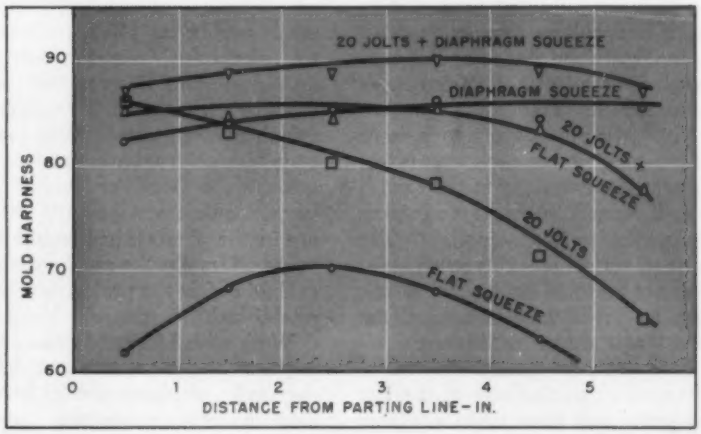
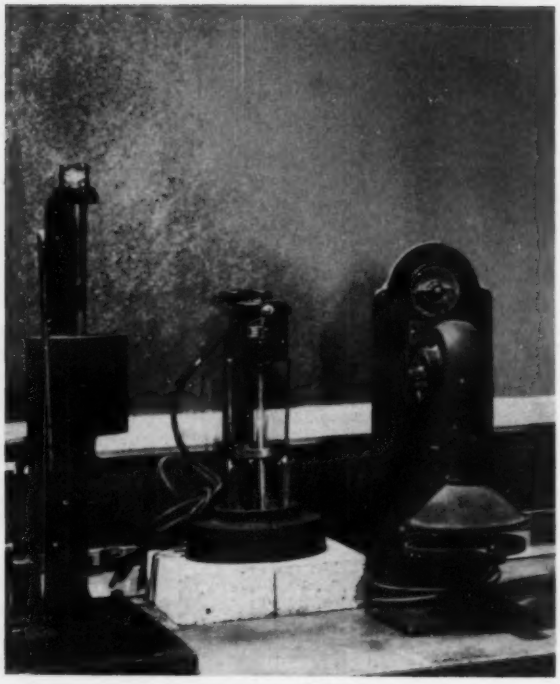
Fig. 21—Comparison of mold hardnesses obtained by various molding processes with 3¼-in. jolt stroke and 65.4 psi squeeze pressure





Here is a method of evaluating molding sand that may enable foundrymen to predict casting quality. To achieve that goal you must . . .

Be Your Own Sand

● SAND CONTROL must be capable of predetermining its effect on ultimate casting quality. Metals have been treated as an engineering material for many years at educational and practical levels. Sands are beginning to get the same treatment, and college degrees in sand technology some day may be conferred, for sand also is an engineering material.

This article endeavors to present a method of green sand evaluation that can be used daily in the foundry. It should enable foundrymen to predict casting quality. For those cases where this evaluation does not seem to apply, the reason may be inability to interpret the facts that stare us in the face.

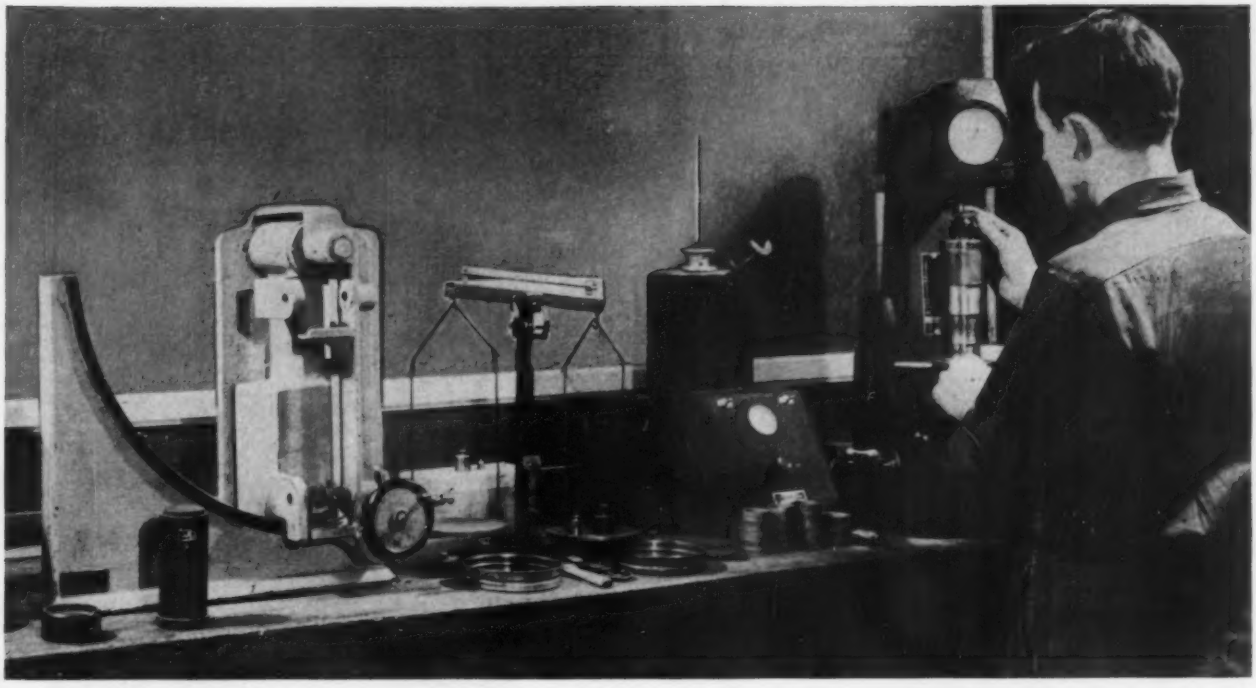
A tremendous amount of useful information, particularly in the last few years, has been made available to foundrymen through multiple research in foundries, laboratories, and universities. Each study has contributed to the predictable pattern of sand operation.

In our laboratory we run tests on customers' sands to help them with sand problems. This laboratory was established over 17 years ago, and during 1960 over 500 sands from more than 250 different foundries were tested. Our laboratory technicians have not been in many of the foundries involved, and our traveling service men seldom are in the plants when troubles develop. Usually the service men are called in after the problems are well established.

Work with Limited Data—In our laboratories we are confronted with the task of determining from a sand sample submitted, usually without other data, what the problem is and what can be done to correct it. The method of evaluation used is applicable to green sand mixes for molding all types of commercial alloys.

The following example describes the analysis of a synthetic green sand with which a gray iron foundry was having trouble producing satisfactory castings, ranging in weight to 400 lb.

The first tests run were the usual tests that are made for normal daily control in the foundry. In American Foundrymen's Society sand testing procedures, the physical properties are measured at the three-ram level. This consists of preparing the specimen with three drops 2 in. high of a 14-lb weight on a weighed sample of sand in a 2-in. tube, so that the sand sample



Detective

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is 2 in. long plus or minus 1/32 in. In addition, a screen and clay analysis is made in accordance with AFS standard procedures.

With regard to the green sand in our example, the standard moisture, permeability, and strength tests do not indicate any unusual variation. The screen analysis does offer a clew, because it indicates that the foundry is attempting to run a four-screen distribution. The sand, however, does not quite match a proper four-screen spread, which should be as follows: No more than 4 per cent 40 mesh and larger, 10-15 per cent on the 50 mesh, 25-35 per cent 70 mesh, 25-35 per cent 100 mesh, 10-15 per cent 140 mesh, and approximately 6 per cent distributed on the 200 and 270 mesh and on the pan.

The screen analysis, Fig. 1, shows 7.4 per cent grains larger than 40 mesh. Since 4 per cent is the maximum amount of large grains that can be absorbed by a four screen distribution without adversely affecting the finish, the foundry obviously is having a finish problem. When coarse or rough finish shows up it is common practice to add a fine sand to "smooth it up."

However, if the correct choice of grain distribution in the fine sand is not made, then the sand can develop a wide distribution and actually make the problem worse or develop other sand problems such as high expansion, low permeability, and gas defects.

Sands Are Sensitive — Foundry sands are just as sensitive to variations in screen analysis as they are to changes in moisture. Either can cause finish or defect problems. Therefore, with 7.4 per cent content of large grains, it becomes important to reduce this quantity to 4 per cent or less. The 50 mesh is a little high, the 70 mesh is within limits, the 100 and 140 mesh are a little low. The 200 through the pan is within limits.

A discussion with the sand supplier will determine what can be done to obtain a sand or several sands that will balance out the screen spread to its proper limits. The corrective action may require only altering the core sand mix to provide a better blend in the shaken out cores which get into the system. Or, if core sand does not infiltrate in sufficient quantities, then the correct additions of new sand may be made directly into the sand system.

It is well known that a true four-

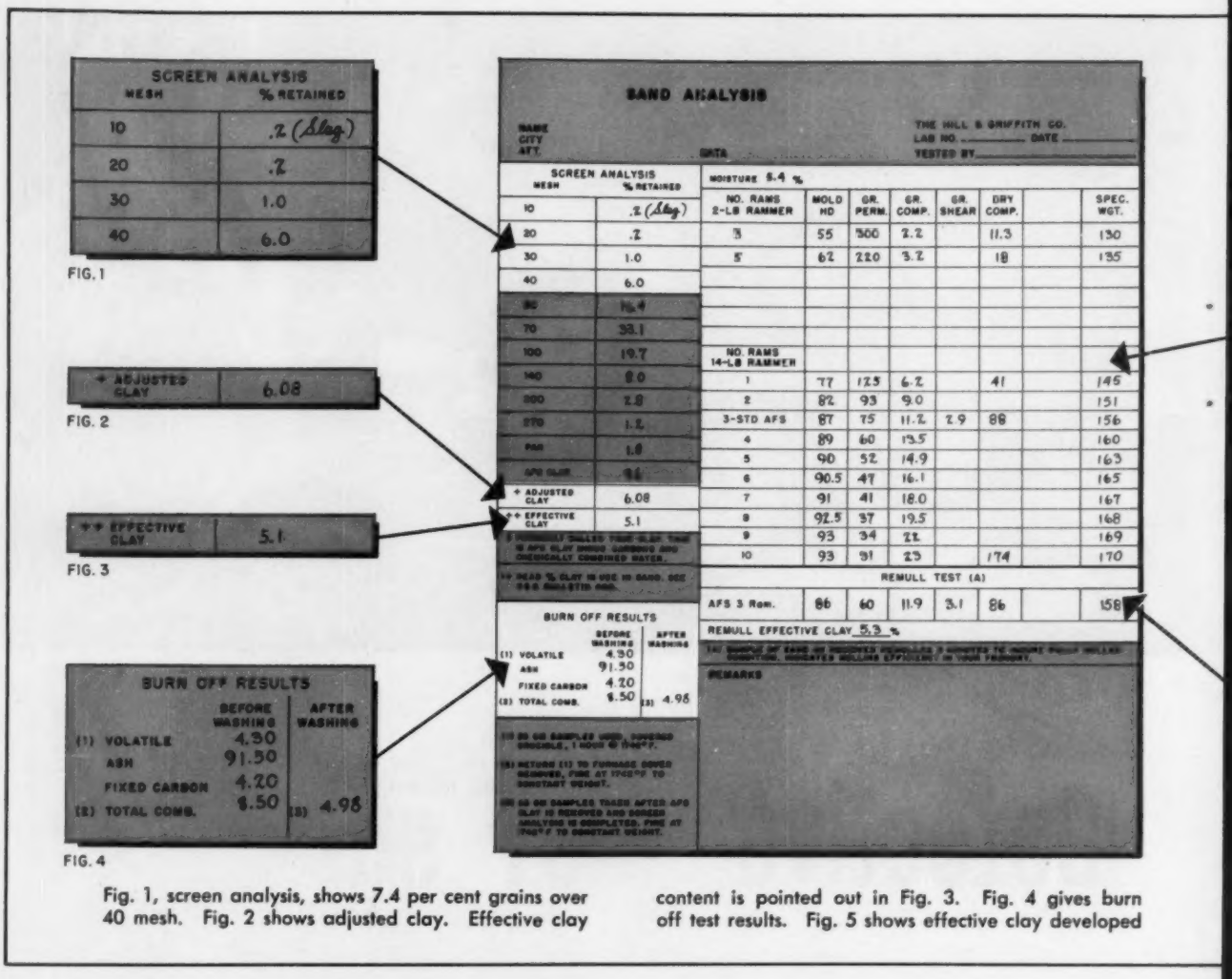


Fig. 1, screen analysis, shows 7.4 per cent grains over 40 mesh. Fig. 2 shows adjusted clay. Effective clay content is pointed out in Fig. 3. Fig. 4 gives burn off test results. Fig. 5 shows effective clay developed

screen spread is an easy sand with which to work. It offers wide latitude in operations, and provides a stable mold wall when rammed—less subject to mold wall movement. Castings produced in molds of such a sand have dimensional accuracy and a minimum of expansion difficulties.

This is not meant to imply that a four-screen spread is the only correct one. It is the best known and most widely used, because natural deposits of sand with that screen spread are numerous. Data are available on two, three, five and six-screen spreads that have many of the characteristics of the four-screen distributions, but they are not easy to find or must be achieved by blending. Any distribution chosen is sensitive to change and must be controlled carefully for best results. Therefore, the analysis of the sand mix in our example indicates that a change in screen distribution must be made.

Clay Content — It would seem that the clay content as determined by AFS standard testing methods should be satisfactory, but let us take a closer look. Clay content generally is composed of new clay, burned clay, carbon, ash, seacoal, cellulose, and anything that will float. AFS Clay may be defined as any sand mix material that will settle at less than 1 in. per minute in still water. Consequently, AFS Clay may be composed of many things, some of which are not clay and do not function as clay.

About five years ago, the True Clay Test was developed, and recently it was accepted as a new AFS standard. It takes into consideration the amount of carbonaceous material washed out with the clay. That amount is subtracted from the AFS Clay figure. True Clay is called Adjusted Clay in Fig. 2. The percentage figure is 6.08.

To arrive at a closer evaluation of the actual clay content, the Effective Clay Test was developed.[1] It is based on the amount of new clay that would have to be added to the sand grain fraction to obtain the properties achieved with the original sand, see Fig. 3.

Effective Clay Test — Effective clay is determined by a green shear test at the three-ram level. This is not an easy test to run, as it is very sensitive to careless operation. For example, the sand being

NO. RAMS 2-LB RAMMER	MOLD HD	GR. PERM.	GR. COMP.	GR. SHEAR	DRY COMP.		SPEC. WGT.
3	55	300	2.2		11.3		130
5	62	220	3.2		18		135
NO. RAMS 14-LB RAMMER							
1	77	125	6.2		41		145
2	82	93	9.0				151
3-STD AFS	87	75	11.2	2.9	88		156
4	89	60	13.5				160
5	90	52	14.9				163
6	90.5	47	16.1				165
7	91	41	18.0				167
8	92.5	37	19.5				168
9	93	34	22				169
10	93	31	23		174		170

FIG. 6

REMULL TEST (A)							
AFS 3 Rem.	86	60	11.9	3.1	86		158
REMULL EFFECTIVE CLAY 5.3 %							

FIG. 5

by the Remull Test. Fig. 6 presents the physical properties at various mold hardnesses.

tested must be screened through a six mesh riddle into a container that can be kept covered. That is done to break up any lumps and to prevent moisture loss during the test.

The sample made must be exactly 2 in. long and 2 in. in diam. The test equipment must be in exact alignment. On this test the green shear was found to be 2.9 lb. To convert the green compressive green shear strength relationship into per cent effective clay, refer to Fig. 7.

The green compressive strength is shown as the vertical line at the left and green shear strength on the horizontal line at the bottom of Fig. 7. At the top are listed bentonite and above that, fireclay. The bentonites are either western or southern or any combination of the two. The solid diagonal lines are the compressive-shear relationships for the given clay content shown at the top. The point at which compressive and shear fall on any diagonal line is the result of moisture content.

Thus it can be said that the chart is not dependent upon moisture content of the sand for determination of the effective clay content. The important thing is that moisture be held constant during the testing for shear and compressive strengths. The drier the sand, the higher up on the diagonal line the intersecting point will fall. The wetter the sand, the farther down the diagonal line the point will be.

Notice that a dotted band intersects all the diagonal lines. For most foundries the area enclosed by this dotted band is the area where compressive-shear strength relationships should fall for best results. It could be called the optimum area of operation.

The sand is too dry above the top of the band. Dry strength will be low; molds will have friable edges and show ramoffs and dirt. Below the dotted band is the area of excess wetness, producing low flowability and rough castings.

Therefore, the proper moisture content of a sand can be determined by adjusting the moisture until the shear-compressive strength relationship falls within the broad operational band. For this particular sand the shear strength was 2.9 lb and the green compressive strength was 11.2 lb. The Effective Clay Chart, shown as Fig. 7, indicates that 5.1 per cent of western or southern bentonite or combination thereof is the effective clay content.

If this amount were added to the sand grain fraction of the screen analysis and then fully mulled, the same relationship of shear and compressive strengths would be found. It would fall on the same diagonal line. Experience has shown that for this particular screen spread, 5.5 per cent effective clay is necessary in a well-rammed mold to prevent dirt in the casting. At least this much clay is required to hold the sand grains in place. Therefore, our test shows that the clay content is too low in this sand and must be raised.

What Is Latent Clay? — The amount of good clay present in the sand that is not being used is called latent clay. The amount is determined by the Remull Test in the following manner: The sand as received is remulled in a laboratory muller for five minutes to develop the clays fully. The sand then is rechecked for green compressive and shear strength. The new effective clay is read from the Effective Clay Chart, Fig. 7. The difference between the new and original values is the amount of latent clay present in the sand. This remull test shows 5.3 per cent effective clay, Fig. 5, not enough to bring the sand to the required 5.5 per cent minimum.

In many cases the Remull Test indicates a high percentage of latent clay present in the sand. That indicates that the mull cycle

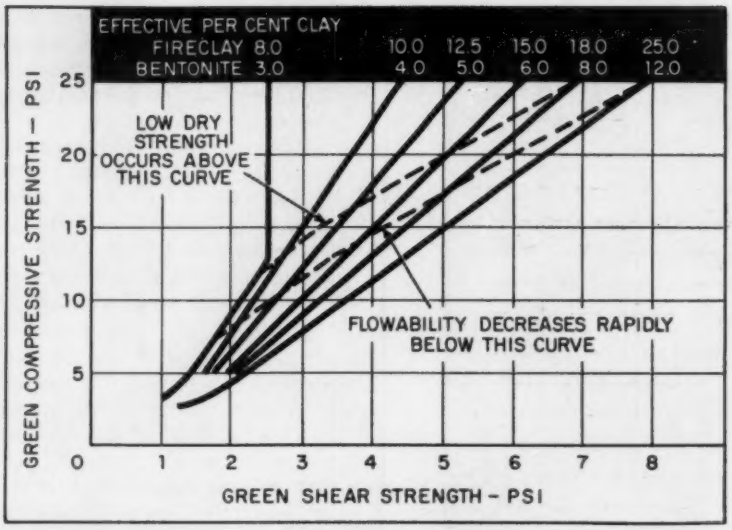


Fig. 7—Effective clay content of a molding sand can be determined on this chart from the green compressive-green shear strength relationship. That relationship for a given clay content shown at top is represented by the solid diagonal lines

is too short, the muller is out of adjustment, the plows are worn, or that the sand is hot. Thus, many things other than equivalent clay content can be learned from the Effective Clay Test.

The amount of clay required in the sand is related directly to the surface area of the sand mass. As sand grains become finer, more effective clay is required to "cement" the grains together. Therefore, in this sand the clay is too low and, no doubt, there is dirt in the castings.

Need More Facts—Still this does not give us all the facts. A carbon test must be run on the sand to determine if the sand will peel from the casting.

The usual laboratory test run is for total combustible material only. In this case it was 8.50 per cent, as shown in Fig. 4. But again this means little, because if it is realized that the volatile portion of the total combustible materials is the only part that makes a casting peel (there are a few exceptions), then the volatile portion must be determined. This sand contained 4.3 per cent volatile material — not enough in this case for effective peel. Therefore, carbons must be revised.

The final steps in the appraisal of this sand relate to its response to ramming. Seldom does a foundry ram molds to the same level of hardness produced by the three-ram AFS standard laboratory test. So, for a full understanding of the ram characteristics, it is necessary to test the sand at a wide variation in mold hardness.

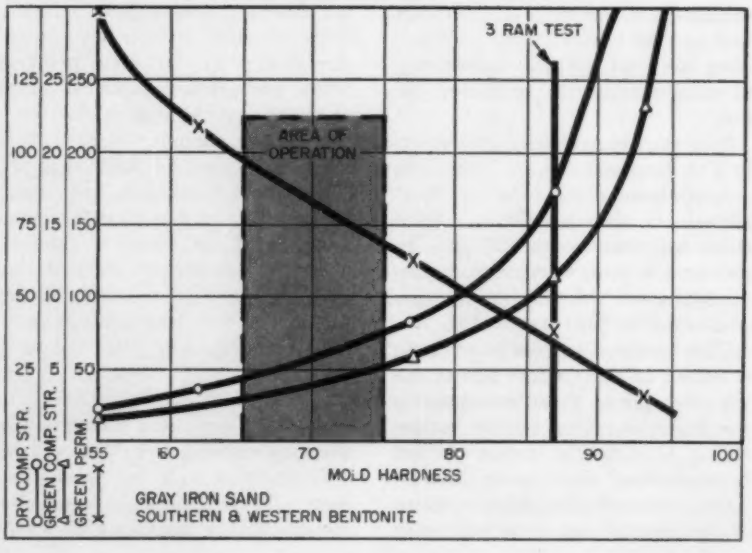
That is done either by changing the weight on the sand rammer or altering the height the standard weight is dropped. Either way the ramming energy against the sand is changed. It still is necessary to produce a 2-in.-long, 2-in.-diam test specimen. Therefore, as mold hardness or ramming energy is changed, the amount of sand required to make a specimen also is changed. For a given sand, once the weights required for each level of ramming are determined, they remain reasonably constant. Variation in sand weight requirements indicates a change in the sand.

Fig. 6 shows the physical properties for this sand at a wide variation in mold hardness.

Physical properties of a green sand mold can be translated directly to the laboratory results by matching mold hardness readings. As shown in Fig. 6, if this foundry is ramming to 55 mold hardness level, then the sand in the mold has 300 green permeability, 2.2 psi green compressive strength, and 11.3 psi dry compressive strength. If the sand is rammed to 77 mold hardness, then the permeability has dropped to 125, the green compressive strength is up to 6.2 psi and dry compressive strength is 41 psi. Further, at 93 mold hardness, the permeability is 31, green strength is 23 psi, and dry strength, 174 psi.

Thus, most any physical property can be obtained, depending on how

Fig. 8—Operating curves developed from test data on a particular sand sample. Hardness readings taken on molds made from this sand are used to determine mold physical properties at the test points. Shaded portion shows area of operation for this sand



the mold is rammed. After all, the physical properties in the mold are what count, not the single set of results obtained at the three-ram level used in daily control testing.

Develop Operating Curves—Operating curves shown in Fig. 8 can be drawn from the data above. These operating curves refer to the particular sand sample we are studying. Use of the curves is based on mold hardness readings taken on molds made from this sand. Then by reading the matching mold hardness number on the graph, the intersecting point on the curves directly above can be read for the physical properties in the mold at the point tested.

In this particular case, it was known that the molds are rammed between 65 and 75 mold hardness. This has been marked on Fig. 8 as area of operation. At 65 mold hardness, the permeability is 200, the green compressive strength is 3.3 psi, and dry strength 20 psi. At these levels, penetration, burn-in, cuts, washes, and dirt can be expected. At the highest level of ramming in this shop, 75 mold hardness, permeability would be 135, green strength 5.5 psi, and dry strength 35 psi. At this higher level dirt problems would be reduced but roughness and penetration still would exist.

With these facts, recommendations can be made: 1. Revise screen analysis. 2. Raise clay content slightly. 3. Revise type of carbon addition. 4. Ram mold to a higher level of hardness.

Consider Other Factors—A service man with this information can plan the corrective measures that must be taken for this foundry's problems. However, several other factors that do not show up on a laboratory analysis must be checked:

1. Is enough new or shaken out core sand entering the sand system? Experience has shown that about 5 per cent new or shaken out core sand should be added to each cycle of system sand to keep the oxide level low enough not to affect dry or hot strength.

2. Metal pouring rates must be checked on time versus weight of metal in the mold. This is important because slow pouring accentuates sand problems, and too fast pouring encourages turbulance.

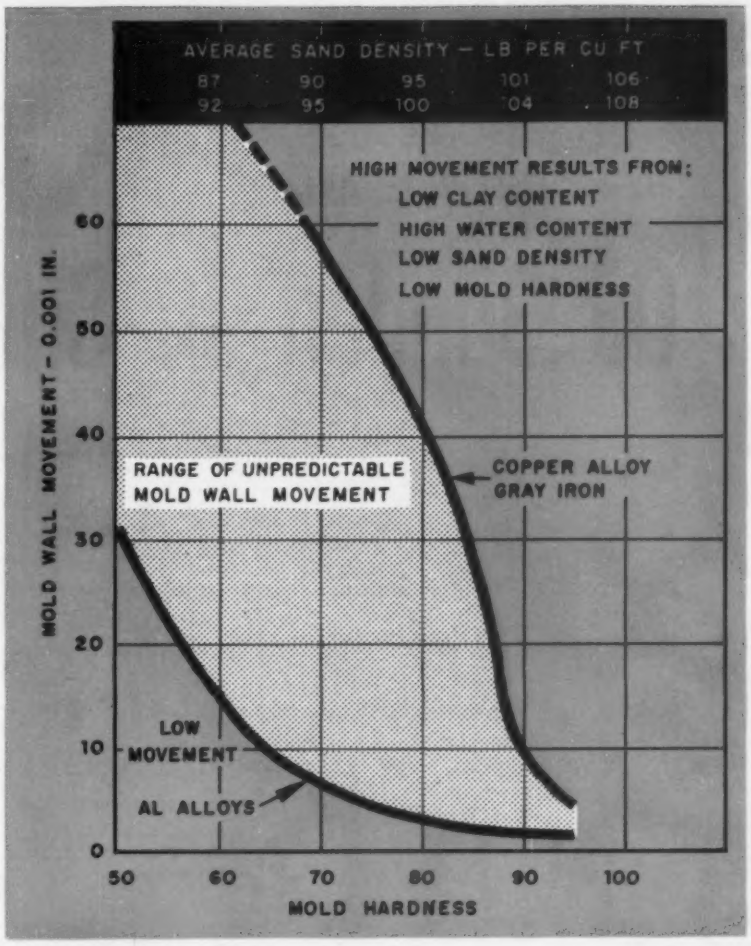


Fig. 9—Effect of mold hardness on mold wall movement caused by aluminum, copper-base alloy, and by gray iron in molds rammed from an 89 AFS fineness sand bonded with 5-15 per cent southern bentonite and containing 2.5-6.6 per cent water

3. Because of the importance of mold wall movement to casting accuracy, the relationship of wall movement to mold hardness should be checked, Fig. 9.

If the sand mix in our example were rammed to 65 mold hardness, the mold wall movement would be 0.065 in., as shown on the gray iron curve, Fig. 9. At 75 mold hardness, up to 0.050 in. mold wall movement could be expected. If this foundry were running at 90 mold hardness, then mold wall movement would be down to 0.010 in.

This then is how a service laboratory can analyze sand. The equipment used is found in most sand laboratories. With the exception of moisture tests required to maintain uniformity, only one test per cycle of the sand need be made on a complete basis.

With an operational curve graph, Fig. 8, showing properties of the sand at various levels of mold hardness, a line foreman can control his operation to a better degree. He will know, with a little experience, what physical properties are necessary in the sand to produce good castings.

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How Materials Affect

Oil Bonded and Shell Cores

Core sand is a complicated mixture. Varying amounts of additives affect its properties, and individual additives vary in their characteristics. Even sand grain size alters the effect of additives. And how often have you considered the effect of the interrelationship of all core mix materials?

By E. C. ZUPPANN
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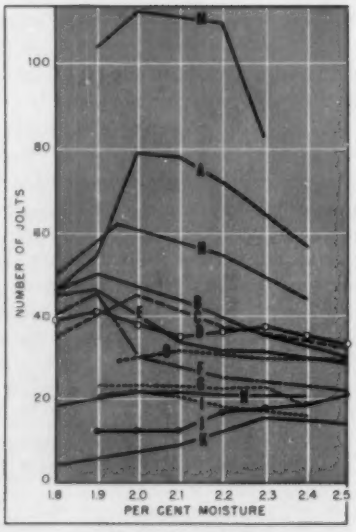


Fig. 1—Water content affects jolt overhang strength of core mixes with 0.66% core oil and 1.5% of cereals A to O

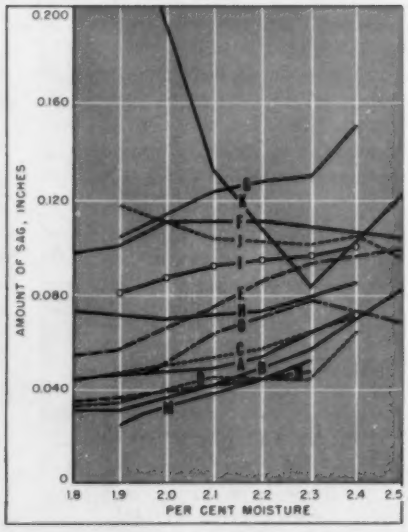
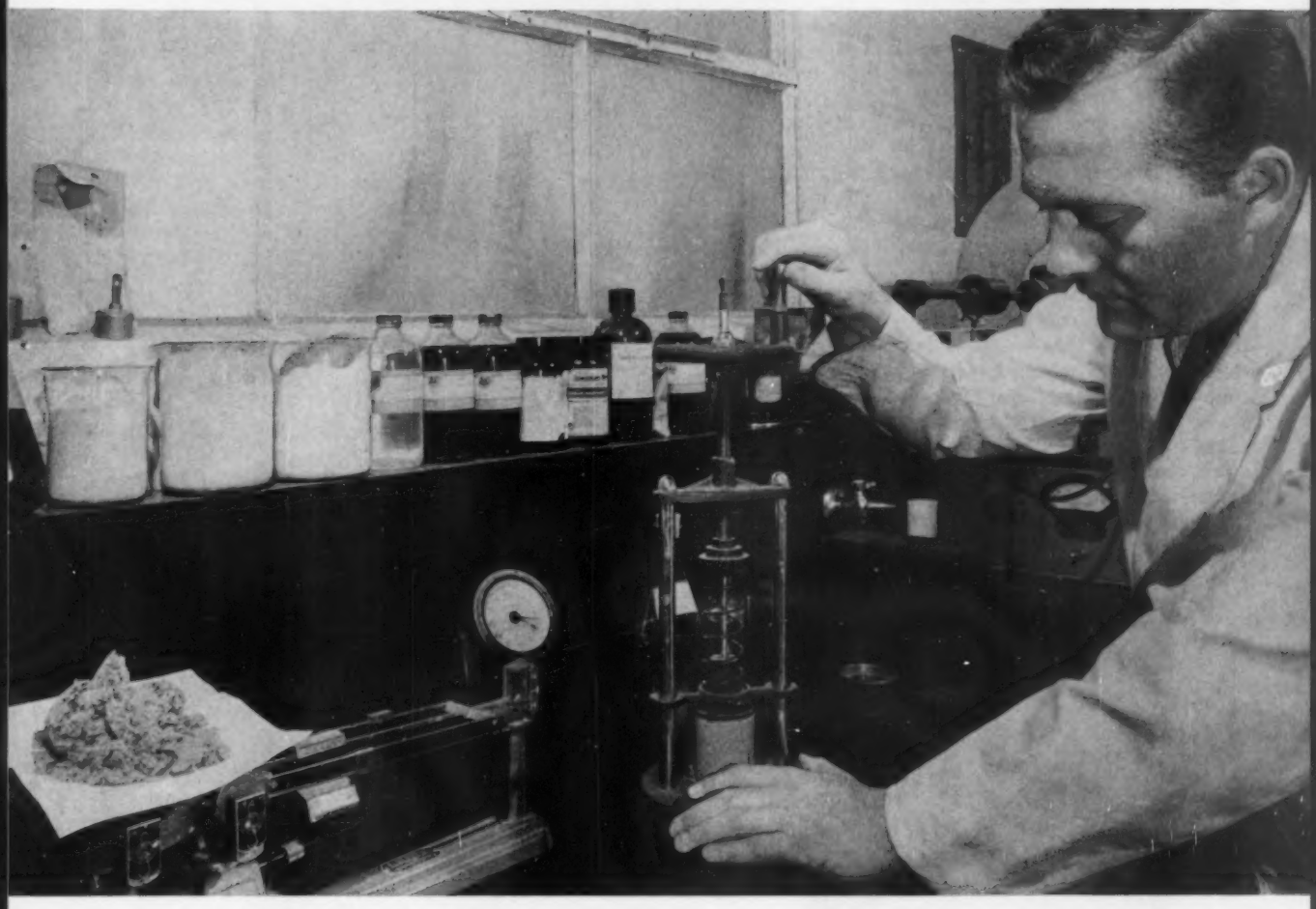


Fig. 2—Effect of moisture content on the amount of sag of the same lake sand core mixes described in Fig. 1

● PRODUCTION of good oil-bonded cores depends on abilities of the coremaker and on core sand properties. Sand properties vary with varying contents of moisture, clays, and core oils. Another variable exists that has a pronounced effect on properties. That variable, not always recognized, is the interrelationship of all core mix materials.

In previous work on evaluation of cereal binders, it was shown that different cereal binders have a moisture content at which each functions best.[1] In all subsequent testing, this best moisture level was used. When quantities of cereal were varied, the moisture was varied in direct proportion.

The sand mixes were evaluated with the jolt overhang and jolt sag test on blown specimens.[2] One of the principal precautions found nec-



essary with this test was to allow the sand to stand 2 hr in a sealed can before blowing. This procedure gave consistent results which closely approached coreroom conditions under which small cores are made. Test results also have been consistent in their ability to predict success or troubles with different cores.

The work described in this article extends that previously done on evaluation of cereal binders.[1] Many of the tests were performed with several sand mixes, each prepared with a different cereal. In some cases only two cereals were used. One was considered superior and the other inferior. These extremes of cereal were tested for their reaction with the other core mix ingredients.

Unless otherwise stated, all sand mixes contain 0.66 per cent of the same core oil and 1.5 per cent cereal. The oil selected gave average jolt overhang and sag results when compared with several other core oils.

Effect of Moisture—Fig. 1 and 2 show the effect of different moisture contents on a mix of lake sand, core oil, and various cereals. In general, the overhang strength decreases on all cereals as they near 2.5 per cent moisture. Each cereal has a moisture content at which the overhang strength is highest. The best moisture level varies from 1.9 per cent for some cereals to 2.5 per cent for others. These data indicate the value of determining a cereal's best moisture level before a comparison with other cereals is made.

The resistance of a core to sagging decreases above 2.3 per cent moisture content for this test mix. Fig. 2 does not show very definite points of greatest sag resistance. The leveling off of the sag resistance at lower moistures may indicate a low value in this area. The necessity for accurate moisture control in core sands is indicated by these first two graphs.

Effect of Cereal—Cereal binders differ widely in their effect on the jolt properties of a sand mix. Fig. 3 and 4 show a comparison of various cereals when used in different amounts. The moisture content of each mix was in direct ratio to that previously found best for each cereal.

Overhang strength under 120 jolts shows a definite fan-like pattern. High strength values were caused by a change in the action of the muller with high strength mixtures.

The heavy line at 50 jolts on Fig. 3 indicates a desired strength for a particularly strong blower sand mix. To obtain a mix yielding 50 jolts for overhang would require 1.38 per

cent of Cereal A and over 2.00 per cent of Cereal K. The same condition for these cereals also existed in the coreroom.

The general decrease in resistance to sagging when less cereal is used is expected. Of note is the lack of change in sag resistance with changes in amount of Cereal D. Economy would probably indicate the use of Cereals A, B, or L, depending upon whether overhang strength or sag resistance was considered most important.

Southern Bentonite Effect—In an effort to bolster the sag resistance many foundries use southern bentonite in sand mixes. Preliminary tests had shown southern bentonite to be superior to western bentonite under various conditions, including core removal. Fig. 5 and 6 show the effect of adding small amounts of southern bentonite. As expected,

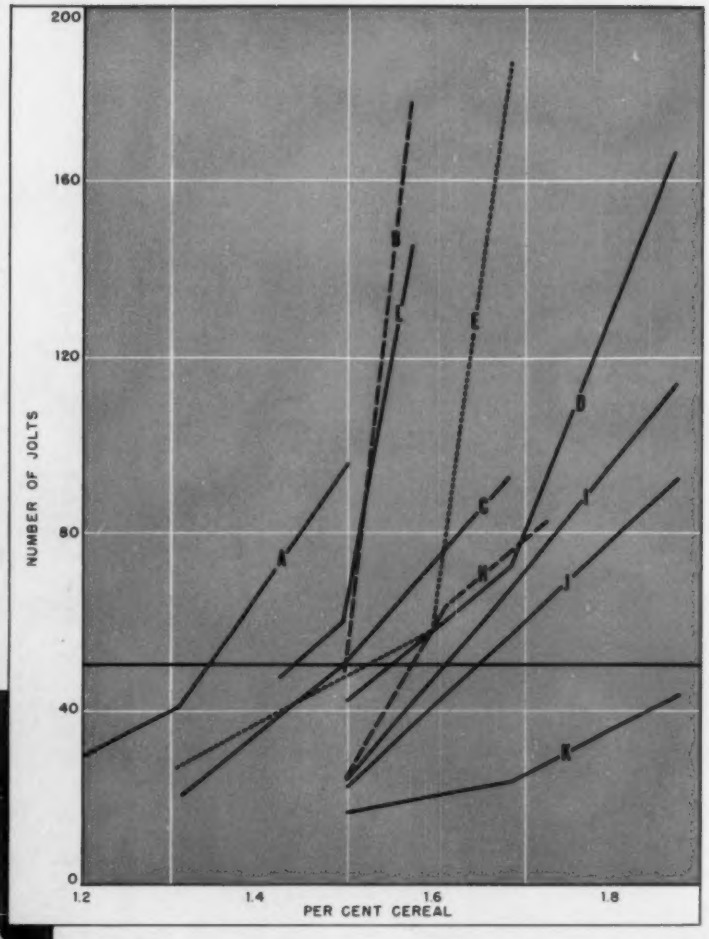


Fig. 3—Changing the amount of cereal in a sand mix affects the jolt overhang strength. Various cereals were used, and each was tested at its best moisture level

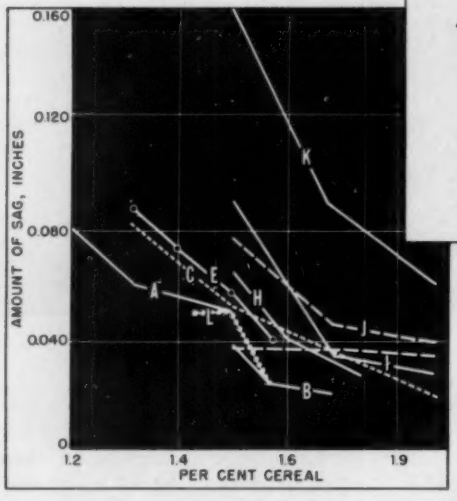


Fig. 4—The effects of different amounts of various cereal binders on the sag test results are compared in the chart shown at left

the resistance to sag increased markedly except in one case. The decrease in sagging amounts to 80 per cent in one case.

The effect of 0.20 per cent bentonite is nearly the same as 0.30 per cent except for the overhang strength of Cereal A. Here again, evaluation of the effect of southern bentonite must be made only with due consideration for the cereal binder. The use of southern bentonite will decrease sag and may increase the overhang strength.

Effect of Other Clays—The effect of 0.30 per cent additions of several clays to Cereal A was determined. Data in the following table indicate that clays increase green compressive strength. However, again we find that there is no relationship between green compressive strength and the two jolt tests. The low compressive strength with high sag resistance, together with a relatively high overhang strength, makes southern bentonite the proper clay to use with Cereal A.

	Jolt Overhang	Jolt Sag	Green Compressive Strength
0.30% Fireclay #1	1059	0.013	1.1
0.30% Fireclay #2	833	0.016	1.1
0.30% S. Bentonite	813	0.011	0.8
0.30% Fireclay #3	734	0.017	1.0
0.30% W. Bentonite	172	0.015	1.3
No clay	95	0.050	0.7

This lake sand mix also contained Cereal A and core oil.

Effect of Grain Size—The size and distribution of sand grains could be expected to influence jolt properties. The majority of tests were made with lake sand mixes. A series of tests was made with mixes incorporating combinations of lake and bank sands. The lake sand was an AFS 58 from near Michigan City, Ind. The bank sand was an AFS 100 sharp sand from northeastern Michigan.

The proper moisture levels for Cereals A and J to obtain the best results when used with all bank sand were determined. The testing results were similar to those shown in Fig. 1 and 2, except that mois-

ture contents were higher. Proportionate moisture contents were used to satisfy requirements of the cereals used in the various mixtures containing lake and bank sand.

Test results are shown in Fig. 7. With additions of fine sand a decrease in permeability and an increase in green compressive strength can be expected. A significant difference can be noted in overhang strength of the two cereal mixes with additions of fine sand. Both cereals were affected proportionately in their resistance to sag. A broader and finer grain distribution can be said to have a greater resistance to sag and may have greater overhang strength.

The use of bentonite and the use of a wide grain distribution sand helped increase sag resistance and overhang strength. What happens when they are used together? Fig. 8 and 9 show test results on sand mixtures containing Cereals A and J. Little change occurs in the overhang strength of the mixes containing Cereal J when either the sand or the bentonite in them is varied.

In contrast, 400 per cent increase in overhang strength is shown by the mix containing Cereal A, when sand grain distribution is changed and southern bentonite added.

Sagging decreases to a greater degree with additions of 0.30 per cent southern bentonite than with additions of bank sand. The use of southern bentonite decreases sagging to such a degree that the addition of bank sand makes little change. Bank sand usually is added for reasons other than to prevent sagging.

Effect of Core Oil—Previous work indicated that the effect of core oil on jolt properties was tied in with time.[1] Fig. 10 illustrates the deterioration of overhang strength with time. The sand mixes contained two cereals with two core oils. This graph shows that time is a large factor in jolt test properties. This is true also in the coreroom. Both the cereal and the oil are important in this reaction. The compatibility of a particular core oil with a particular cereal should be checked before use.

Summary — These data have shown that the various commercial cereal binders available have vastly different reactions with moisture, sand, clays, and core oils. Experimental results obtained with one cereal are not necessarily duplicable with all other cereals.

This work has indicated that evaluation of any one ingredient in a core mix is influenced by all the other materials. A comparison of two brands of an ingredient may show opposite results when they are used with different attendant materials. Evaluating any one ingredient by mixing it with only sand may give misleading results. A true evaluation of any ingredient can be made only by including many mixes, containing several quantities and various brands of all materials in core sands.

SANDS FOR SHELL CORES

Interest currently is running high in hardened-in-the-box core processes. The shell method was the

Fig. 5—Using southern bentonite with various cereals in sand mixes affects jolt overhang strength as shown below

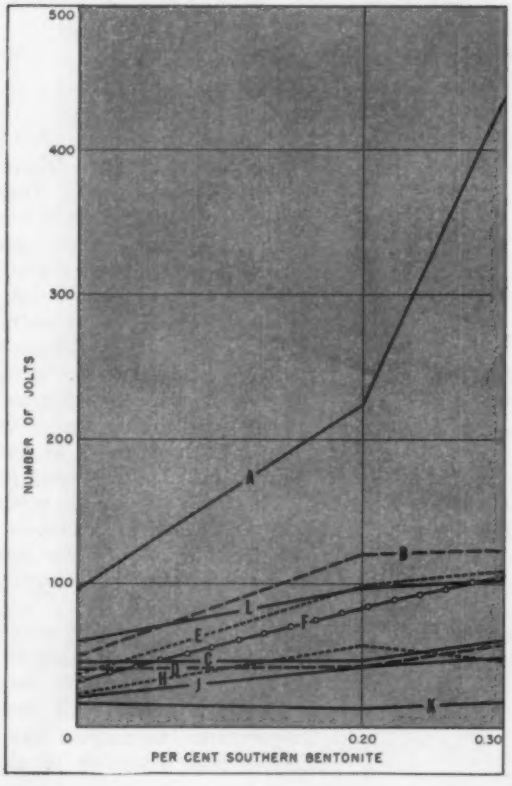
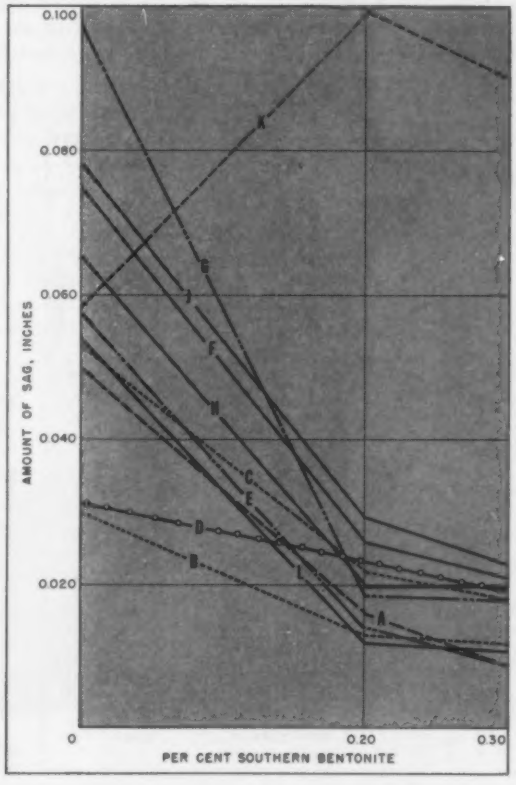


Fig. 6—Additions of southern bentonite to sand mixes with various cereals also affect sag test results



first commercially-accepted process and is probably the most debugged.

Selection of Sand—Grain size of sand used for shell cores varies from 35 to 120 AFS fineness. The spread of grains is over two to six screens. A good rule to follow, when selecting a sand, is to use the coarsest size possible and still meet finish requirements.

Any setup for coating sand with resin should have facilities for using two or three raw sands and for handling several finished sands. Although one sand may be used on the vast majority of jobs, special mixes will come in handy on a few of them. By using the coarsest sand possible, less resin is required; therefore, less gas is produced, and a higher permeability exists for venting gas.

A wide grain distribution should be chosen to minimize heat shock. Pan material should be avoided since it requires excessive resin for bonding. Although low clay content is desirable, none at all may cause heat-shock cracking. The clay content must be consistent and dependable because of its effect on strength.

The surface condition of sands from different deposits varies greatly. A smooth, round grain requires less resin than a subangular or pitted grain. This surface variation can cause a 20 per cent difference in resin requirement.

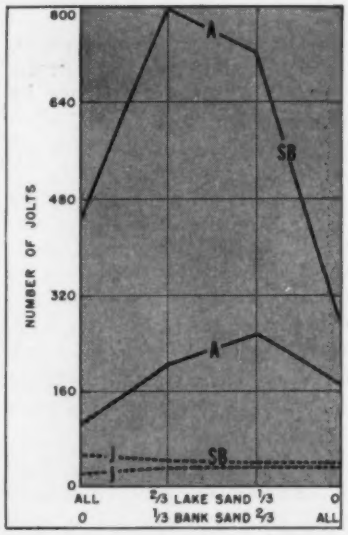


Fig. 8—Adding 0.30% southern bentonite to mixes with Cereals A and J and varying lake-bank sand content affects jolt overhang strength

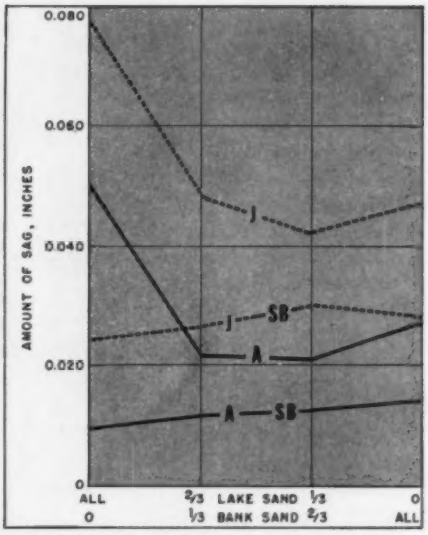


Fig. 9—The effect on sag test results of 0.30% additions of southern bentonite to sand mixes described in Fig. 8 is shown

The amount of resin required for adequate bonding also varies with sand grain size. How great is the variation? Suppose we are using a 100 AFS fineness sand with 4 per cent resin. We have available a 50 AFS fineness sand. How much resin should we use for our first trial?

AFS grain fineness numbers are proportional to the surface area of the sand, and we are coating that surface area. Since the 50 AFS fineness number is half of the 100 AFS number, we would use just half as much resin, or 2 per cent. This new mix should give cores that are about as strong as the originals.

On one core that gave us blows, we made physically satisfactory cores from the following:

AFS No.	Type	% Resin
100	Bank	4.3
55	Lake	2.5
40	Silica	1.75
35	Silica	1.5

Resins for Coating — There are two basic types of resins: Thermoplastic, which softens when heated, and thermosetting, which hardens when heated. Although single stage thermosetting resins are used, the majority of coating resins are of the two stage type. The latter are thermoplastic when the sand is coated and are chemically changed to thermosetting as the core is cured. These resins are known as novalac and are available in several forms. The chemical change is produced by the reaction of ammonia and formaldehyde released by heating hexamethylenetetramine, commonly referred to as hexa.

We must coat the sand with thermoplastic phenol-formaldehyde resin (novalac) and hexa without heating the hexa to its reaction temperature. The simplest way is to dissolve both materials in alcohol

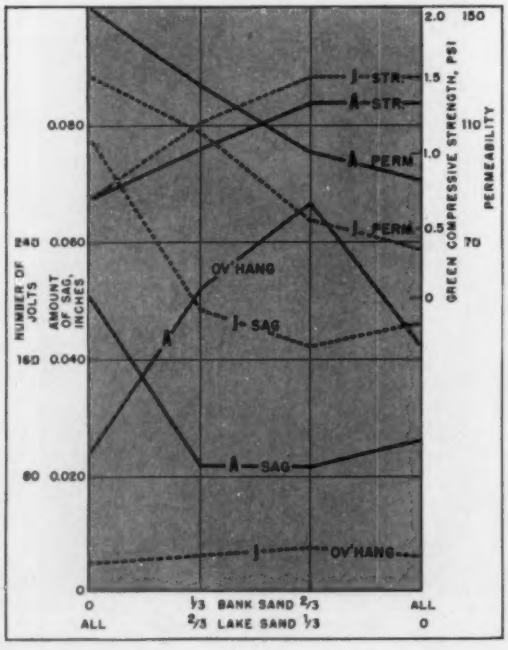


Fig. 7—Different ratios of lake and bank sand in mixes with superior and inferior cereal binders influence various test results

and water. This may be done by purchasing the resin as a liquid already dissolved in alcohol, or other organic solvent, and adding a water solution of hexa. Another way is to use a mixture of powdered resin and hexa which is mixed with the sand. A mixture of alcohol and water is added to dissolve the two basic materials and coat the sand.

In either case, the sand is mulled with this mixture, making a stiff, doughy wad. If given enough time, even in a conventional open mixer, the alcohol and water will evaporate leaving a free flowing, resin-coated sand. To speed the process, room temperature air may be blown through the sand; this is cold coating. Air heated to 225-300° F will decrease the time by 40 per cent; this is warm coating.

The sand usually is discharged while still somewhat lumpy to minimize abrading the resin coating off the grains. Screening completes the breakdown, while travel through a cyclone unit completes the removal of moisture.

Hot Coating—The second basic method of coating is by melting the thermoplastic novalac onto sand grains at 300-350° F. The mass is mixed thoroughly in a muller or pug mill. After cooling to below 225° F, the hexa is added.

A lubricant or release agent, calcium stearate or wax, is added generally late in the cycle.

Some variations in coating cycles are used, although wide variations are not common in the cold or warm coating methods. The resin purchased determines the product and its action. One may buy a low hexa resin and vary certain mixes by increasing the hexa additions. Fast or slow curing resins or resins with longer or shorter flow characteristics are obtainable. Characteristics of fast and slow curing resins are given in the following table:

Cure	Flow	Tensile Strength	Buildup	Drain
Fast	Short	Low	Slow	Good
	Medium	Good	Medium	Medium
	Long	Low	Slow	Low
Slow	Short	Low	Slow	Good
	Medium	Good	Medium	Medium
	Long	Low	Fast	Low

Materials may be added to reduce thermal shock effect. They include iron oxide, bentonite, silica flour, calcium carbonate, thermoplastic resins, talc, lead oxide, activated alumina, and probably some others.

Variations in the hot coating method include the use of the same special materials. The time and especially the temperature involved are critical but can be varied for special effects. The resin may be started on its cure, or advanced, by adding the hexa at an elevated temperature.

This addition may be a small part of the total added at high temperature and allowed to break down completely. The balance is added after the water quench. Another variation calls for adding all the hexa first so that it will be mixed into the resin coating and therefore be highly effective when it breaks down. In this case the resin is melted carefully onto the grains at a temperature just slightly below the reaction temperature of hexa.

Hot coating uses less costly ingredients than cold coating and gives a harder, more abrasion-resistant coating that requires less resin. Variations of the hot coating cycle as to time and temperature allow the coater to tailor-coat sands for specific jobs. These variations can be sources of trouble, however, when consistency is required. Cold and warm coating, because of their simplicity of cycle with few variations, are more trouble free.

Control Methods—As with most sand tests, those developed for shell core sand mixtures are primarily for controlling consistency. Some of the properties determined by these tests are: Loss on ignition, tensile strength, transverse strength, stick-point, hot tensile strength, and hot shell deflection.

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1. E. C. Zuppann and H. Putz, "Evaluation of Cereal Core Binders," *Transactions, AFS*, Vol. 64 (1956), pp. 267-270.
2. E. C. Zuppann and H. Putz, "More Revealing Green Core Test," *Modern Castings*, March 1956, pp. 34-36.

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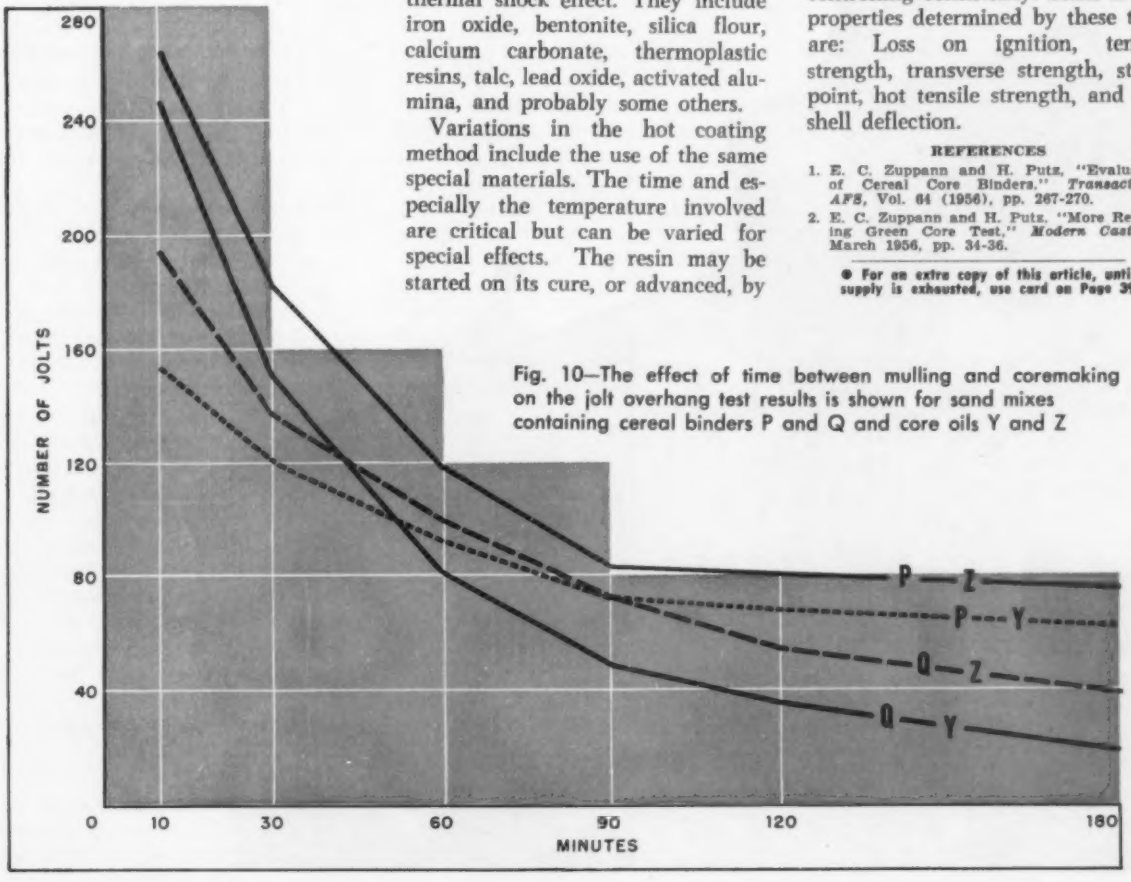
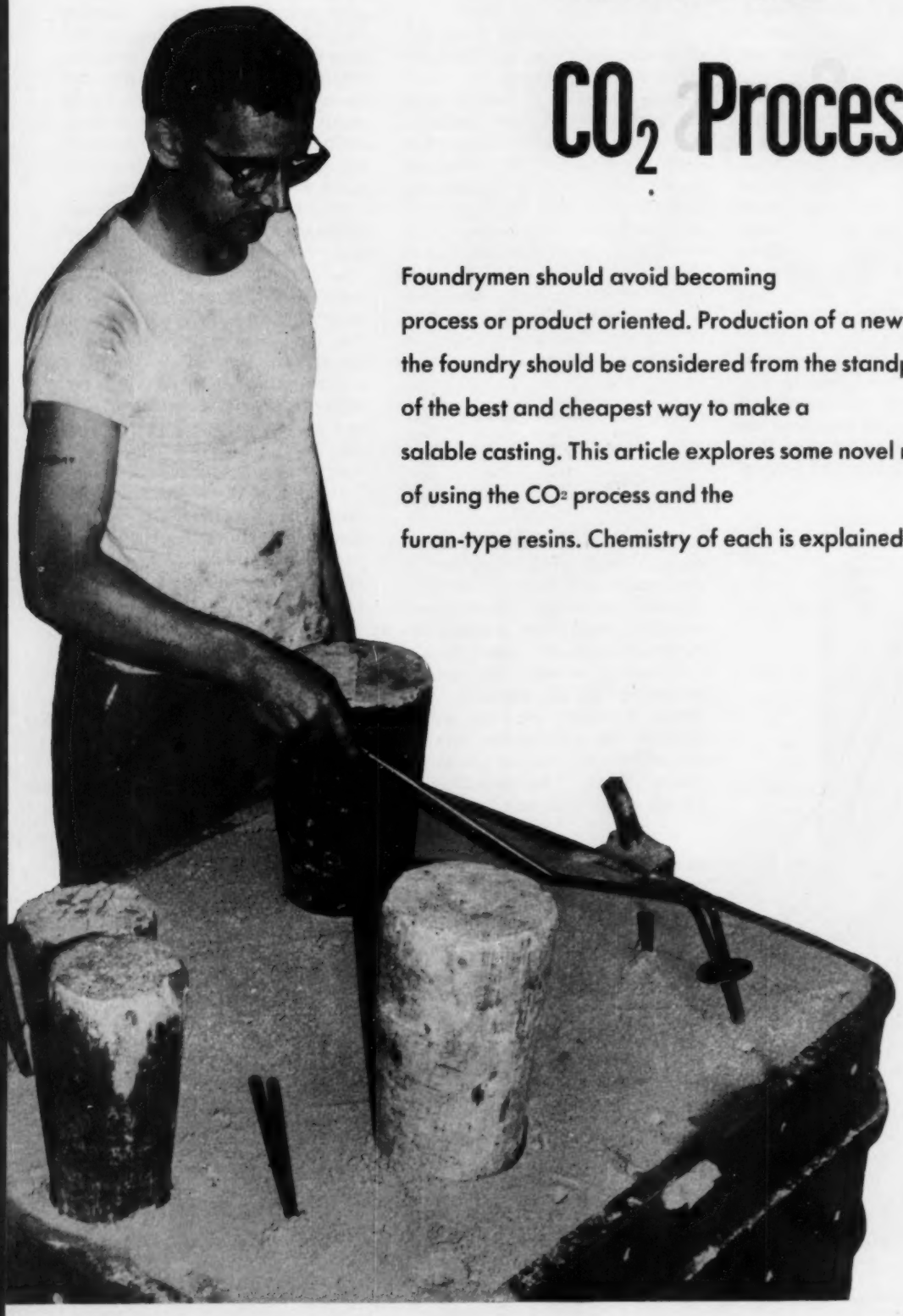


Fig. 10—The effect of time between mulling and coremaking on the jolt overhang test results is shown for sand mixes containing cereal binders P and Q and core oils Y and Z

How To Use CO_2 Process and



Foundrymen should avoid becoming process or product oriented. Production of a new job in the foundry should be considered from the standpoint of the best and cheapest way to make a salable casting. This article explores some novel methods of using the CO_2 process and the furan-type resins. Chemistry of each is explained

Furan Cores

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● THE FOUNDRY INDUSTRY is fortunate to have available many types of core and mold bonding media. When he understands these materials and their principles of application, the foundryman can select the best one for his specific needs. The best is the cheapest one that does the desired job efficiently.

Caution should be exercised, however, to avoid one's becoming process or product oriented. When deciding how to make a new job that has come into our foundry, we should not say to ourselves, "How can we make this job in a particular binder?" Instead, a new job should be viewed from the standpoint of "What is the best and cheapest type of binder to use to make a salable casting?"

It should be understood, of course, that the cost of the binder itself is not the only thing to consider. The over-all costs or savings realized in labor, time, etc., should be weighed before a decision on which process to employ is made.

Chemistry of The CO_2 Process—A great deal has been expounded on the chemistry of the CO_2 process since its introduction to the American foundry industry in the early 50s. It is questionable, however, whether the mechanism is truly understood by which sand that has been mixed with sodium silicate hardens when exposed to the reaction of carbon dioxide.

The general theory of the process is that sand grains are bonded together by the action of a silicate gel which is produced in the decomposition of the alkaline silicate. An earlier simplification of reaction often quoted in literature is Na_2SiO_3 (aq.) + $CO_2 \rightarrow SiO_2$ + Na_2CO_3.

Other research has attempted to carry out a more extensive investigation of the mechanism of this bonding reaction. Such work reveals that the alkaline silicates consist in the main of meta-di-silicates and that these products ionize to form other ions, etc.

More complex studies by x-ray show that diffraction patterns of freshly formed silicate gels have centers consisting of crystalline cristobalite which is an aggregate of siliceous particles occurring with the formation of a network of hydrated cristobalite.

There is not even complete agreement regarding the reaction of the alkaline silicates with carbon dioxide. It is thought by some that the reaction with carbon dioxide results in the elimination of water molecules between molecules of silicic acid. This formation results in a change or filament of siliceous materials which link and mesh together and produce a rigid gel.

When all is said and done regarding the basic theories concerning the phenomenon of the CO_2 process, it is questionable whether any of the information involved is of value to the practical man in the foundry, such as the coreroom foreman, coremaker, or muller operator. Since it is the prime responsibility of such men to develop and supply a core—or in some cases a mold—which must meet their standard requirements satisfactorily, it is essential, however, that they have a basic understanding of just what does occur when the sodium silicate mixture is combined with the CO_2. The following explanation is offered as a means toward accomplishing this purpose.

Sodium silicate, also known as silicate of soda, or water glass, is considered the base material. When needed, a sugar solution is added to enhance collapsibility. A percentage of this binder is added to dry sand and mixed until a completely satisfactory sand mixture is obtained. The action of the carbon dioxide converts the sodium silicate, and the precipitation of silica in the form of a gel produces immediate stiffening between the sand grains. When this reaction occurs, the result is an immediate cementing together of the whole mass into a rigid structure.

It must be understood that the conditions for successful hardening are somewhat critical. They depend on the type of sodium silicate formulation and the moisture balance which exists in the basic sodium silicate product. Care must be taken not to overgas. This action breaks the gel, and in turn the bond is lost between the sand grains.

Gassing Methods—As with the basic chemistry behind the CO_2 process, much has been written about the method of gassing a sodium silicate sand mixture. Reference is made to such equipment as probes, cups, cover boards, manifolds, etc. Fig. 1 illustrates one of these methods of gassing. Let us look at some variations and depart-

ures from the prescribed procedures to newer methods which have been put in use in many foundries throughout the country.

One innovation has been the use of an ungassed sodium silicate sand mixture as a mold-facing medium. Three to four inches of the sand mixture is rammed against the face of the pattern and backed up with heap sand. The pattern is rolled over and drawn, and the mold is allowed to air-harden at room temperature. No carbon dioxide is used to cure the sand mixture in this process; normal amounts of CO_2 in the atmosphere accomplish the curing process during the air-drying time.

The mold is closed, and the casting is poured in the normal manner. Another aid is the superficial heat which comes before the metal and assists the sodium silicate sand mixture by causing it to develop an outer skin surface. Good castings, particularly in heavier section iron, have been achieved by this molding method.

Where there is a tendency toward buckling or other expansion defects, especially on the cope surfaces, expansion control additives such as wood flour or cellulose materials can be used in the usual percentages with the same effectiveness one might expect in normal sand practice. A typical sand mixture for the above application, where exceptional casting finish is desired, is as follows: 100 lb sand, AFS 125; 3-5 lb sodium silicate binder; 2 lb pitch or 1 lb graphite for peel.

This mixture has approximately 4-5 lb green strength. If more green strength is required, add up to 2 lb western bentonite. This should give sufficient green strength for most molding applications. The mix suggested has been reported to produce castings with a finish as good as or superior to those achieved with the shell molding process. It should be remembered, however, that this was accomplished with a very fine sand.

The same basic mixture with a more open sand—for example, AFS 50-55—can be used depending on the casting finish desired. See Fig. 2, which shows the optimum binder per AFS grain fineness number.

For Green Strength—Another application for the sodium silicate process has involved the need for green strength to hold a core in the drier. A midwest foundry formerly added a considerable amount of cereal to a valve core sand mixture. At the same time this small valve core was subjected to heavy metal sections in the casting. Sufficient cereal to give the required green strength invariably resulted in casting blows. The problem was how to obtain the required green strength and at the same time eliminate the blows apparently caused by the organics in the core.

Fig. 1—Worker gasses a sodium silicate-bonded ring core in a mold rigged with tubing to distribute the carbon dioxide throughout the core

To overcome this problem, a straight sodium silicate core was used. This eliminated the blows but created a core knockout problem. After considerable pondering, a suggestion was made to take advantage of both the CO_2 process and the core oil-sand process. The idea was to add just enough sodium silicate to the oil-sand core mix to give adequate handling strength by gassing the silicate and then to obtain sufficient baked strength through the core oil.

After a few trial-and-error combinations with varying percentages of sodium silicate and oil binder, a satisfactory mix was obtained. This mix had the advantage of the handling strength developed by gassing the CO_2 binder in the corebox. In fact, it developed sufficient strength through the use of the CO_2 binder to eliminate the drier completely. Then, in the customary oven baking cycle, the core oil binder took over and completed the bonding action to achieve the maximum bake strength. A typical sand mix for this application is as follows: 400 lb sand, AFS 65; 2 lb sodium silicate binder; 1.25 lb core oil (based on the weight of the sand).

It is true that the mix is somewhat higher in binder content than should be required and that the silicate no doubt detracts from the bond strength of the oil. The complete elimination of the casting defect plus the fact that driers were no longer needed proved this, however, to be an exceptional and worthwhile effort.

Driers Made from Sand—In the same foundry which utilized the sodium silicate binder with core oil, another excellent illustration of the ingenuity used by foundrymen to make the method fit the job was shown.

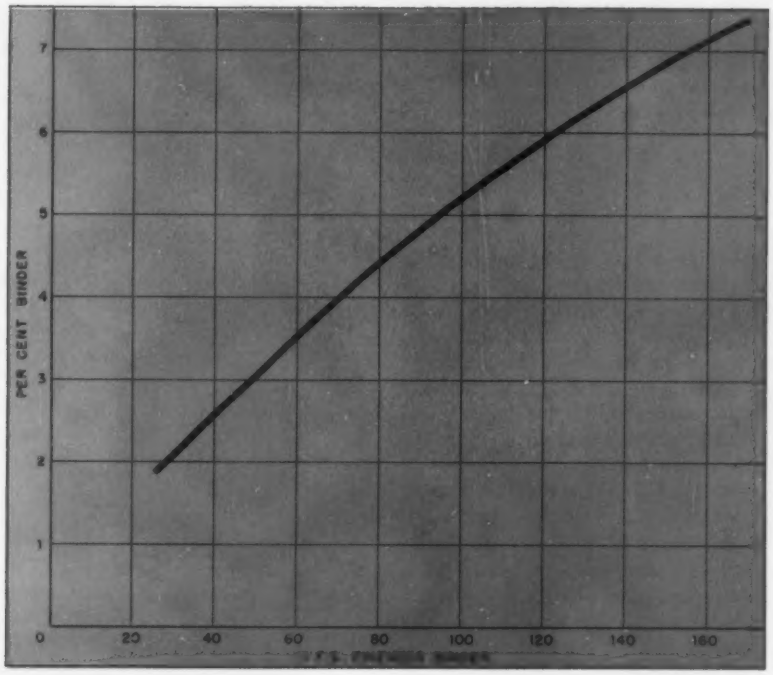

Fig. 2—Graph shows per cent sodium silicate content for optimum binding as required by core sands of various AFS grain fineness numbers

This particular job was a prototype casting requiring cores which of necessity had to be baked in driers. Because it was a prototype core the foundry did not relish the thought of going to the expense of having driers made since there would be a subsequent design change.

The same imaginative foundryman who had come up with the sodium silicate-oil binder combination put his efforts to work on this problem. He reasoned that the silicate-bonded sands would stand a great deal of heat and abuse. Hence, why not make the driers out of a high-ratio silicate-bonded sand? Using the pattern corebox, he made a number of driers which made approximately 50 passes through the core oven at 450° F before they became so weak that they no longer were usable. This example again shows how to take advantage of a known process such as CO_2 and adapt it to fit the job.

Chemistry of the Furan Family of Binders — Tremendous interest has been generated during the last two years in the foundry industry by the new furan types of binders, in which a common constituent is furfuryl alcohol, derived from furfural. Commercial production of furfural in this country is based primarily on corn cobs and oat hulls. Furfuryl alcohol is obtained by the reaction of hydrogen with furfural. Both products can be modified with a number of other components such as urea formaldehyde to produce end resineous binders of widely differing properties.

Furan binders made from furfuryl alcohol and furfural can be polymerized or resinified by heat, by weak acidic catalysts, or by a combination of acid and heat. The monomeric materials probably could be used as binders, but prepolymers or partially resinified systems superior to the base materials have been developed.

Stable resins possessing optimum core binding properties have been produced by careful control of formulation and processing. The curing process is exothermic and thus self-sustaining. Heat generated during curing speeds up the rate of cure.

As would be expected, different furan binders and catalysts are used for hot box, air curing, dielectric, and conventional baking applications. The furan binders fall into two general classifications—that is, the hot box-type of resins and those used in the air curing process.

The one which has received the most attention and publicity in recent months has been the hot box-type of furan resin. In this process, curing is accomplished by both an acidic catalyst and heat. Heat alone is sufficient to cure this resin, but the addition of a catalyst accelerates curing to a great extent.

Process Advantages—One of the advantages which foundrymen have found in this process is its basic simplicity as far as sand mixes are concerned. A normal mix consists of washed and dried sand, catalyst, and a binder. Average bench life of sand mixes used in this process is approximately 3 hours. Since heat will expedite the cure of this type of binder, adequate precautions should be taken to insulate the sand chamber and blow plate on coreblowing machines.

A typical box furan sand mix has a feel and consistency somewhere between those of an oil sand and a CO_2 type. Since this mix is a wet sand type, it can be blown on conventional coreblowing equipment or on the newer, specially modified hot box machines.

Speed of production is the major reason that this process has received so much attention in recent months. Other than speed of production, such things as accuracy, economy, convenience, simplicity, and versatility should be considered advantages of the hot box process.

When the sand-resin-catalyst mix is blown into a corebox heated to 375° to 475° F, the heat from the corebox activates the catalyst and resin and subsequently cures the core. The resin and catalyst sand mix adjacent to the corebox cavity cures immediately, forming a shell around the wet mix. Within seconds, the shell formed strengthens the core to such a point that it can be ejected from the corebox, either by stripper pins or vibration. Because an exothermic reaction carries on, the core cures throughout in a short period of time. Curing cycles as low as 3 or 4 seconds have been accomplished.

The curing cycle depends, of course, on the size and configuration

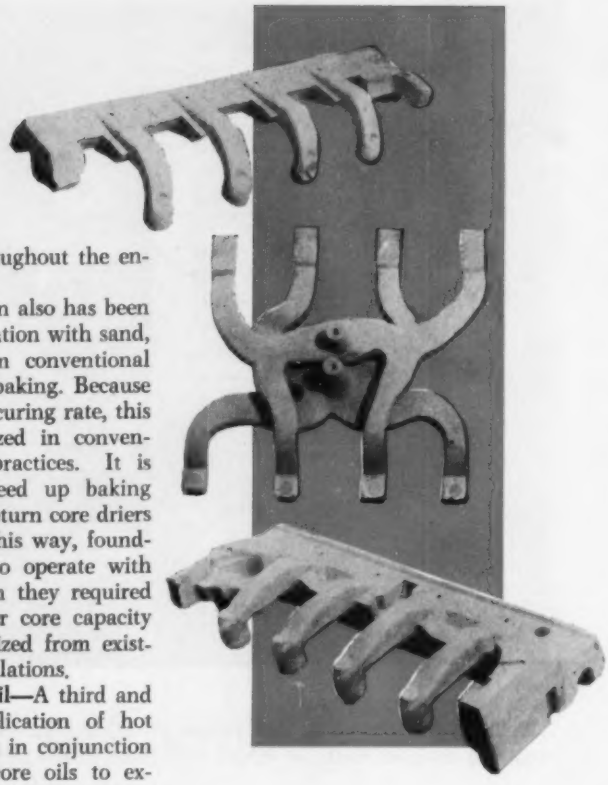

Fig. 3—These cores are typical examples of what can be made by the hot-box furan process. Fast curing in coreboxes makes process useful for high production

of the core which is to be blown and cured. Some foundrymen have chosen to leave the core in the hot corebox only long enough to build up a shell strong enough that the core might be removed from the box. The core then is placed on a belt conveyor and on through a re-dry oven. In this way, these foundrymen are able to realize the greatest production from the coreblowing machine and operator.

A great many of these furan-type cores are placed in the mold after a very short period of time without any core wash. It has been found from experience that a water-soluble wash is the best to use on this type of core. If the cores are dipped immediately after removal from the hot corebox, however, there is a decrease in tensile strength. Therefore it is advisable to permit the core to go through its exothermic stage and cure throughout before it is dipped into the core wash.

Iron Patterns—Cast iron pattern equipment is recommended for use in this process because it generally maintains good heat control even though a wet sand mix is being blown. If desired, corebox equipment can be built with lighteners. Where the core will be subjected to heavy metal sections, ribs can be inserted to help support it during pouring.

The catalyst used in this system is not completely consumed during the curing process. It plays a second role after the mold has been poured by assisting in breakdown of the bond, enhancing good collapsibility. A properly cured core shows a uniform coloring which is very close to the original color of the sand mixture.

Any evidence of dark brown coloring on the core surface indicates areas of over-cure. This condition, of course, affects tensile strength and scratch hardness of the core in this area. For this reason, anyone considering the hot box process should be willing to build adequate pattern equipment with good temperature control throughout the entire core cavity.

Hot box furan resin also has been employed in combination with sand, cereal, and water in conventional oven and dielectric baking. Because of its extremely fast curing rate, this binder can be utilized in conventional coremaking practices. It is now possible to speed up baking cycles and thereby return core driers at a faster rate. In this way, foundries now are able to operate with far fewer driers than they required in the past. Greater core capacity thereby can be realized from existing core oven installations.

Use With Core Oil—A third and greatly utilized application of hot box resin is to use it in conjunction with conventional core oils to expedite or speed up baking. In many instances the combination of core oil and hot box resins has shown economies in the sand mix. Baking speed can be increased from 20 to 50 per cent by replacement of approximately one-quarter of the core oil which would normally be used in a core oil sand mix with furan resin. Workability and green strength are relatively the same as with a conventional oil-sand mix.

The biggest single advantage to this mix is that baking cycles can be reduced greatly. Some foundries also have found a reduction in scrap due to core breakage in driers because of the rapid curing of the core in the drier. Fig. 3 shows some typical cores made by the hot box furan process.

In summary, the three ways in which furan resin can be used include the hot corebox, conventional dielectric oven baking, and core oil and furan combinations. In all three, the major advantage is the increased speed of cure which can be realized.

Where high production rates are not required, the second type of furan binder is utilized. In this process, cores can be fabricated and completely cured without baking. An active acid catalyst is mixed with the sand and furan binder. The chemical reaction between the acid and the furan completely cures the core or mold. Working and stripping time of cores and molds made under this process can be controlled by varying the catalyst level. Working time with the sand mix can in this way be regulated from 10 minutes to more than an hour. This process should not be confused with the air-set process, in which additional heat is required to polymerize the binder.

As in the hot box application, the cure reaction is exothermic. Because of this action, a temperature rise usually can be detected from the curing core or mold. By the use of this process, core and mold drying ovens can be eliminated, and the space can be converted to useful coremaking operations. Obviously, a great deal of handling also can be eliminated.

Minimizes Rigging—In large core work, the core can be completely cured in the box. Tensile strengths can go as high as 350 psi in such unbaked cores and molds. It is possible to strip cores from the box merely by using the crane to draw the core. As a result, a great deal

of rigging, as well as rolling over of coreboxes, can be eliminated. Fig. 4 shows a typical furan-type core drawn from a corebox directly, without a rollover operation. Because of the tensiles obtained and the fact that the core is cured when handled, a large number of cores, rods, and wires can be eliminated.

The air-set furan binder and catalyst has moderate hot strength at 2000 to 2400° F. This is about the equivalent of a sand mixture containing 4 to 5 per cent western bentonite. It also has been noted that moderate plasticity at high temperatures is developed in cores and molds, reducing veining tendencies.

In molding, this type of furan mix is applied 3 to 4 in. over the pattern surface and is backed up with conventional sand. The pattern then is rolled over and stripped. With this method of molding, a great deal of time is saved over the dry-sand type of operation. The use of the furan binder in core and molding applications makes it possible to complete and pour large molds in a single day. Some of these molds formerly took two to three days of fabrication and drying before they could be poured.

To compare the various core and mold making methods available, refer to Table I. In this table, each type of binder and process is graded. The ranks given are in terms of order of preference. No attempt is made to rate the various processes in terms of their relative value in each functional category.

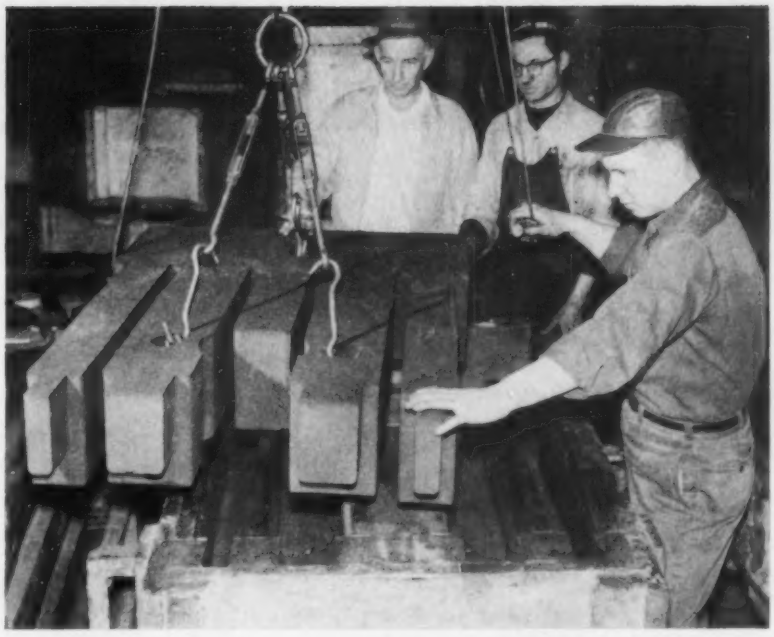

Fig. 4—One advantage of air curing furan binders is that large cores bonded with this material don't require as many core rods and wires or other rigging. Also, as shown here, rolling the corebox over can be eliminated

Every day, foundrymen are applying CO_2 and the furan resins as well as other bonding media in newer and more unusual ways. Getting to know all of these new processes and where and when to apply them is a competitive necessity.

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TABLE I—Comparison of Various Core and Mold Making Methods

BINDER	PROCESS	CURING PRINCIPLE	ACCURACY (Core dimensions)	SPEED OF PRODUCTION (output per worker)	ECONOMY (sand mixture)	CONVENIENCE (Handling tooling or precautions)	SIMPLICITY (Core quality control)	VERSATILITY (Range of metals and core type)
Furan Hot Box	Hot Box	Chemical and Heat	1	1	3	1	2	2
Furan Hot Box and Core Oil	Oven Bake	Chemical and Heat	2	3	2	5	1	2
Furan Air Set	No-Bake	Chemical	1	5	7	3	5	4
Conventional Air Set	Air Set	Catalytic Oxidation and Heat	1	6	6	4	6	4
Core Oil	Oven Bake	Heat	2	4	1	5	1	1
CO_2	CO_2	Chemical	1	2	4	2	4	5
Phenolic	Shell	Heat	1	2	7	2	3	3
Phenolic	Oven Bake	Heat	2	4	5	5	1	3
Urea	Oven Bake	Heat	2	3	2	5	1	4

QUESTIONS and ANSWERS

- **Reduction in pouring temperature is necessary to lengthen thermocouple tip life**
- **Low pouring temperature of lead alloys permits the use of a number of mold materials**
- **Application of wedge bars can be used to establish control of additions in ladle inoculation**
- **Gating method used for brass fittings is a possible cause of shrinkage areas**

Pouring Temperature Is High

We make tin-bronze grave markers and find that we have to pour at 2400° F to get the metal to run in these thin-section castings. Consequently, we find that our thermocouple tips have a short life, and the manufacturer attributes that to the high temperature. Do you know of any other method for obtaining accurate readings at the higher temperature?

Although it is true that shorter life will result when thermocouples are used at high temperatures, the life might be extended by more careful use. Possibly the couples are held in the molten metal longer than necessary, or are pushed in deeper than the 3 in. usually recommended. Another possibility might be that the couples are used at much higher temperatures than mentioned. Also it might be that there is carelessness in adding phosphor copper since, as phosphorus increases, the bronze becomes more corrosive to the tips.

It seems to us that a good place to start would be to take a good look at the gating system employed since the pouring temperature seems about 100° F too high even with light-section castings. We suggest that you increase the number of gates into the casting cavity to permit more rapid flow. That will allow lower pouring temperatures.

Other methods of temperature measurement include use of optical or radiation type instruments which are available from a number of manufacturers.

Molds for Casting Lead Alloy

I am planning to make some small sand-cast figures weighing from ½ to 1 lb each in a lead alloy, and will appreciate receiving any information on how it can be done.

Lead and lead alloys have relatively low melting points—around 620° F—and can be poured into molds made of sand, metal, wood, rubber, and even of paper—as practiced in making stereotypes and mats or plates for printing. Although the melting temperature is low, the pouring temperature must be from 50 to 100° higher so that it will fill the mold.

Since lead is considerably heavier than other metals and alloys, weighing 0.41 lb per cu in. compared with 0.32 for tin bronze and 0.26 for gray iron, certain precautions must be observed in making sand molds. Lead also is quite fluid at the usual pouring temperatures. Therefore, the flasks must be well constructed and rigid, and the sand must be rammed hard to prevent penetration due to the combination of high density and fluidity.

Some operators recommend application of graphite to the mold face and core surface. It is slicked on or rubbed in to fill any voids between the sand grains, but in the case of the figures or statues you mention we doubt if that can be done.

Suggests Wedge Bar Control

We operate a small foundry producing gray iron castings weighing from a few ounces to 10 lb and using matchplates. For several years we have been using an all-scrap mixture plus ladle inoculation to obtain the desired results. Recently our analysis showed a much higher combined carbon than usual, and we would like to know how we can get it back to where it should be. The analysis indicates 2.23 per cent Si, 0.45 per cent Mn, 0.116 per cent S, 2.48 per cent GC and 0.71 per cent CC.

Apparently you are not having difficulty with hard corners or edges in the light section castings you are making or you would have mentioned that. Therefore, unless you have established a definite relationship between structures in the test specimen and the castings, we would not worry much about the fact that the combined carbon appears somewhat high. Cooling rate has an effect on graphite precipitation in gray iron, and it may be in the particular specimen that it may have cooled more rapidly than usual, resulting in less graphite and more combined carbon.

If you are interested in a control to determine the amount of inoculation required, you should use a wedge test. Probably a bar 4 in. long with a triangular cross section having a ¾ in. base and an alti-

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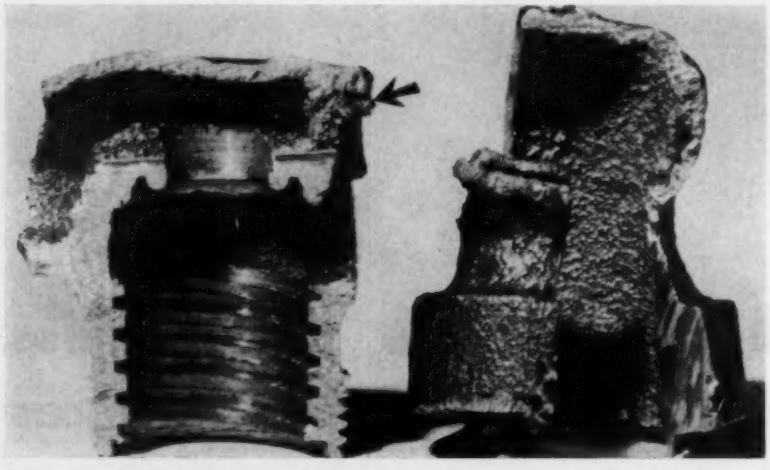
For More Information Circle 593, Page 39

tude of 1½ in. will serve. Such a bar is made in a baked sand mold, and the bar is broken at about the middle of the 4-in. length. The chill is measured from the tip in 1/32 in., and the depth is correlated with results obtained with different casting sections, and with the amount of inoculant to produce the desired results.

Brass Fittings Show Shrinks

In our foundry in Mexico we produce small brass or bronze valves and fittings, and are having considerable difficulty in obtaining sound pieces, the losses running up to 35 per cent. We are sending specimens of the valves and elbows showing the defects, and will appreciate suggestions on remedying the condition.

Examination of the specimens indicates that your problem is one of shrinkage, and we suspect it is due primarily to the method of gating.



Specimens of brass valve and elbow, showing locations of the shrink areas

Possibly it results from trying to pour too many molds from one crucible of metal causing the first few molds to be poured with metal that is too hot, and the last few with metal that is too cold.

Our reason for suspecting the gating is the location of the gate stub on the elbow casting. It is located perpendicular to the flange and the incoming metal must flow around it before entering the remainder of the casting. Usual location of gates into fittings and valves is into the flange parallel to the core print. That permits a straight flow of metal into the cavity.

Although the flanges on the valve body were removed, we assume that the gating was in the same position as on the elbow, and if so should be changed. Also, in placing the gate on the valve it should be located so that the metal flows directly into the seat section. Usually the patterns are mounted on the plate at a slight angle to the runner so that the first metal flows to the end which is extended a short distance beyond the last cavity and then backs up into the casting cavities.

Centrifugal Casting Molds

Can you supply us with information on the best materials for centrifugal molds for a brass foundry, and the relative merits of each?

Most commonly employed material for permanent molds for centrifugal and static castings is gray cast iron. Usually a type with a high total carbon is preferred since it is reported to have a better thermal shock resistance. Steel molds are used to some extent, and so are graphite molds. Graphite can be machined easily and rapidly, but it is a relatively soft material, and can be scratched and marred. However, with careful handling, especially in extracting the castings from the mold, a reasonable life may be expected.

Although we do not have any definite mold life comparison figures, we would expect that steel molds would have a longer life than gray iron molds. Gray iron machines more easily than steel. With either type of material the mold face will have to be coated with a refractory wash of some kind to protect and permit the casting to be extracted readily.

Using Plaster for Patterns

In the July issue, a plaster molding method for producing small bells was described. This was of considerable interest to us, and we would like to know where "casting plaster" can be obtained. Also could that material be used for patterns? We now are using a proprietary pattern compound for that purpose.

Casting plaster is a prepared material composed of 80 per cent by weight alpha gypsum and 20 per cent fibrous talc or agalite. The talc used should not be confused with the ordinary variety since it has, as the name indicates, a fibrous characteristic. The prepared material, casting plaster, may be obtained from several producers.

This type of plaster or gypsum is not suitable for making patterns for production operations as in sand molding since it lacks requisite hardness and is somewhat fragile. However, special hard plaster, usually termed pattern plaster, is available for making patterns for castings, die sinking patterns, tooling models, etc.

Metal Penetrates Into Cores

We are making brass and bronze bushings about 14 in. long, and inside diameters from 1 to 5 in., and are having trouble with metal burning into the cores. Have you any suggestions?

If the metal penetration is confined to phosphor bronze bushings, you will have to use a coating of some type to fill up the exposed pores in the sand mix since those alloys are quite fluid. Many suitable core coatings for the purpose are available on the market. If the trouble occurs with red brass, it may be that more than the usual amount of 2 oz per 100 lb of phosphor copper is being used for deoxidation.

It may be that your present sand is too coarse and produces large surface voids. You could try closing up the sand by addition of fine molding sand, fine silica sand, etc. Again, you do not mention whether

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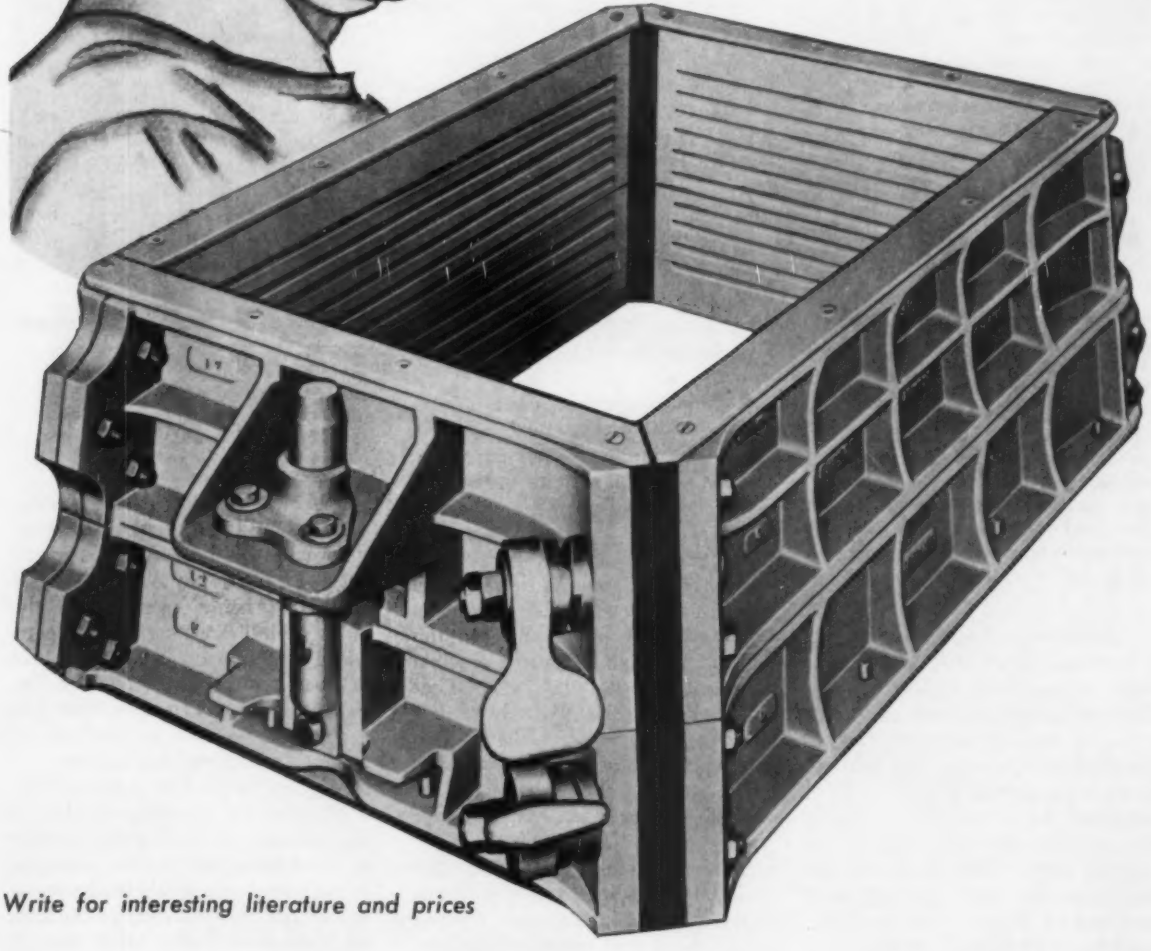

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For More Information Circle 594, Page 39

the condition exists with all core sizes or with only one size. If all cores are baked for the same length of time, you will run into a problem of under or over-baking, depending on the time cycle. Where the cycle is for large cores, the small ones will overbake, and vice versa.

With overbaked cores the surface tends to collapse too soon, permitting metal penetration, and in under-baked cores the excessive amount of gas generated in contact with the molten metal reacts with the metal and causes hot spots.

Finishing of Cast Iron Ware

We are considering the manufacture of cast iron grills similar to frying pans or skillets except that they are larger. We would like to know how the fine finish is obtained on kitchen ware, the dark color, and how the "break-in" is accomplished. By that we mean that the ware is ready to use as is. Also, are the pots machined inside to obtain the fine finish?

Presumably your reference to fine finish applies to the interior appearance of cast iron ware. It is obtained by grinding and polishing operations, no machining being done.

First operation is with grinding wheels followed by use of abrasive impregnated fabric wheels called set-up or polishing wheels. Exterior surfaces, except for the bottoms, are not treated, and the relatively smooth surfaces result from the fine sands used in molding. Bottoms of the ware are ground and polished to insure the requisite flatness. We believe the dark appearance of the exterior or skin is that naturally occurring after removal of the castings from the sand.

The break-in you mention is accomplished by treating the surfaces, particularly the interior, with one of the edible vegetable oils used in cooking, and then baking the coated ware in an oven at temperatures which are used in cooking. This makes it unnecessary for the housewife to perform the operation prior to use. It also leaves a slight coating of oil on the surface which protects the surface from rusting before reaching the user. The slight coating is easily removed by washing with detergent or soap.

Pouring a Small Amount of Metal

Can you offer any suggestions on a method of pouring a definite amount of yellow brass at 2000° F? We are interested in pouring 2 lb brass plus or minus one oz or so at a time, and have attempted to do that by using a measuring ladle to dip from the crucible. After employing various types of ladles and coatings on them, we still are unsuccessful since the brass sticks and builds up, reducing the volume of the ladle.

One possibility for pouring a definite quantity of metal is use of electrically heated ladling furnaces in which the desired amount of metal is ejected through a nozzle by a controlled air pressure applied for the requisite period of time.

Another device would be a tiltable pouring cup mounted on a weighing device such as a scale or strain gage, but such a system presents two problems. One problem would be controlling the stream into the cup to meet the close tolerance in weight, and would necessitate a small stream. The other would be maintaining the pouring cup at a temperature high enough to prevent metal from freezing onto the walls.

Perhaps heavy insulation on the exterior of the cup would decrease the rate of buildup, but for best results it seems that some method of external heating of the cup would be required.

As you undoubtedly realize in your present method of dipping, the buildup of metal on the walls is due to loss of temperature in the ladle during handling from crucible to pouring station and back. That might be overcome partly by immersing the ladle in the molten metal for a short time before dipping out. Another way would be to have several dip-out ladles and a small high-temperature furnace beside the crucible in which they could be placed. In this way one ladle could be used for dipping until the metal begins to adhere. Then it would be placed in the furnace for reheating while a preheated ladle is being used.

Needs Increased Temperature

We are attempting to produce high-alloy valve seat inserts in green sand and are having trouble with interdendritic shrinks in the center and inside diameter. The alloy contains about 2.75 per cent TC, 2 per cent Si, 3 per cent Cr, and 4.5 per cent Mo. We are pouring from a crucible at 2650 to 2750° F.

Although not indicated, we assume that the valve seat inserts are produced by stack molding with small, thin gates leading from the central sprue into the mold cavities. Since the castings have relatively small cross sections, they must be poured at high temperature, and we suspect that is your problem. You mention a pouring temperature of 2650 to 2750°, which we assume is measured at the furnace, and probably will be at least 50° lower at the mold side.

We suggest that you try increased pouring temperature and observe the results. We understand that one foundry brings the molds to the furnace and pours directly from it to avoid temperature drops in handling the molten metal. Melting temperature is reported to be about 2800° F, and with this arrangement temperature loss is slight.

Spots on Surface Are Spongy

In casting white iron pieces we sometimes encounter a spongy effect from ⅛ to ¼ in. deep in spots on the casting surface. Can you suggest the cause and remedy?

Lacking a specimen for examination, we only can guess at the possible cause of the defect. It might be a form of pinholing resulting from slag being carried into the mold cavity. According to Heine, white cast irons tend to form iron oxide-rich slags which may be carried into the mold cavity. The slag reacts with carbon in the iron to form CO, causing the pinholes.

We are inclined to believe, however, that the condition is due to the presence of excess moisture, clay or sand balls, tramp iron, wood, or other foreign materials in the molding sand. Also it might result from hard ramming. The latter may be just enough to reduce the permeability of the sand to a point that the metal does not lie quietly.

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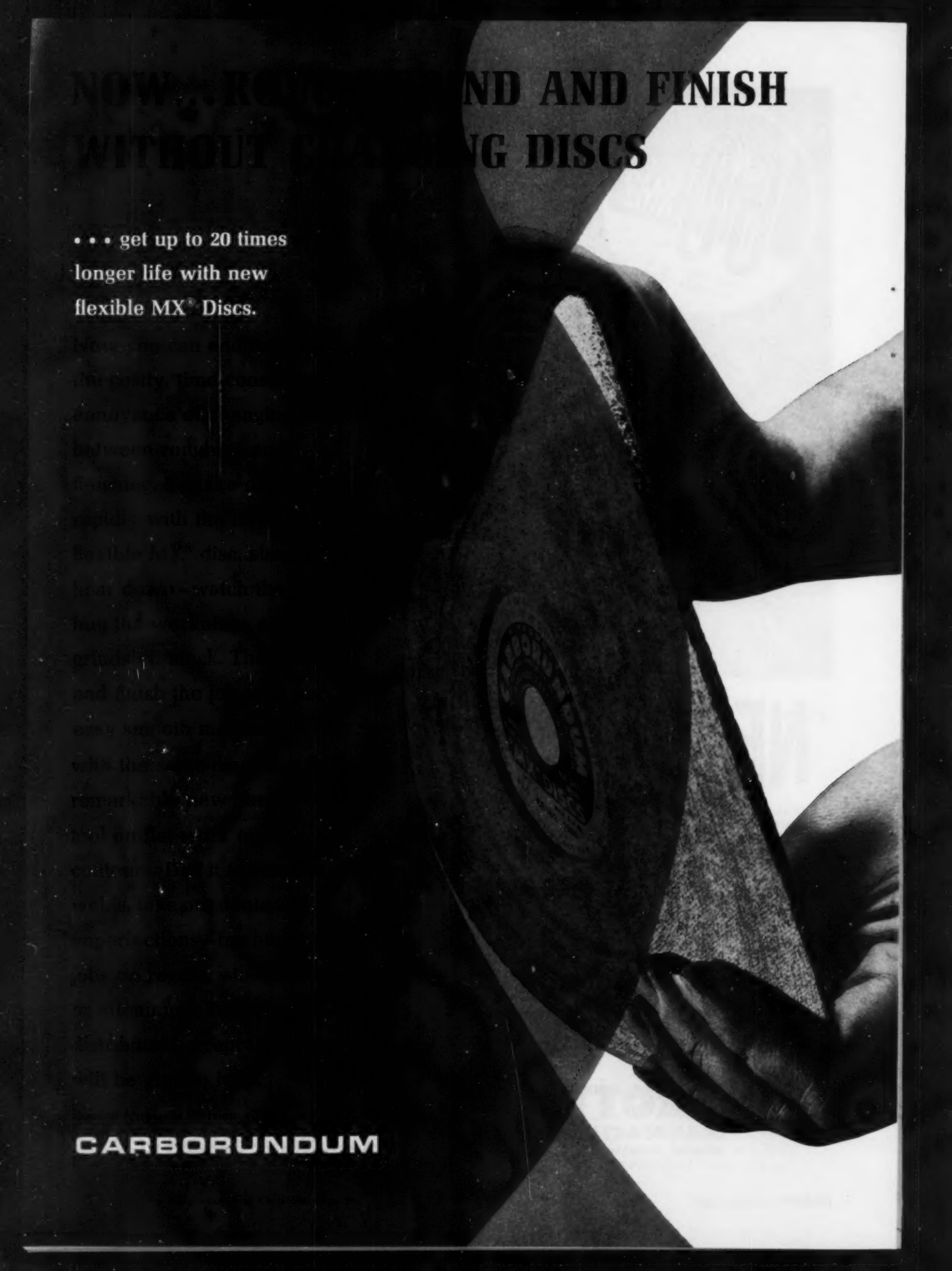
For More Information Circle 595, Page 39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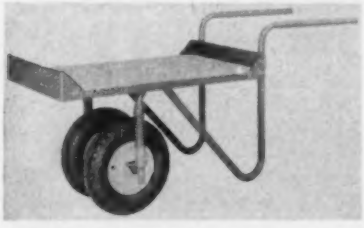
FLASK TRUCK

Type E-4 hand truck is for conveying flasks, bottom boards, jackets, and patterns. Truck has a load capacity of 700 lb. It comes in two sizes; one size has a loading surface of 36 x 48 in. and a vertical nose of 30 in., the other has a loading surface of 30 x 48 in. with a vertical nose of 36 in. Wheels are 16-in., ball bearing units mounting pneumatic tubeless tires. Each truck is constructed of 12 gage sheet steel, properly reinforced. Trucks can be made to customer's specifications.—**AWS Foundry Supplies & Equipment**, 4727 S. Hoyne Ave., Chicago 9, Ill.



For More Details Circle No. 451—Page 39

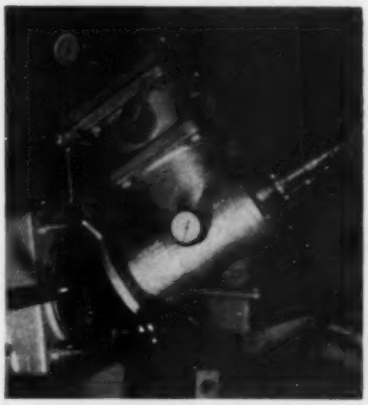
PORTABLE BLOWER

All-aluminum portable blower, No. 18-N-52A1, weighs approximately 70 lb and delivers up to 6500 cfm. It is powered by a 1½-hp motor which operates on either 220-440 v ac or 110-230 v ac or dc and is available in standard and explosion-proof models. Over-all, it is 21⅛ in. long, 21 in. high, and 20¾ in. wide; the air duct is 18 in. in diam. Unit operates in any position without loss of efficiency. Safety features include waterproof and vaporproof switch, screen guards on inlet and exhaust, balanced fan blades, and thermal overload protection for the totally enclosed motor.—**Manhattan Electric & Maintenance Co.**, 24 Siegel St., Brooklyn, N. Y.

For More Details Circle No. 452—Page 39

FURNACE BURNER

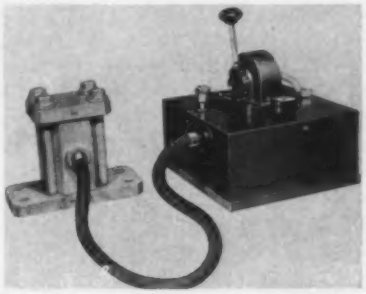
Furnace burner is hinged so it can be withdrawn from the burner tuyere and swung up out of the way at shutdown. This eliminates the need to pass air through the burner internals to prevent them from deteriorating, and excess thermal shock to the furnace refractories also is prevented. After the burner is swung out of the way (see illustration), the furnace can be sealed to conserve heat and reduce preheating time the following day.—**U. S. Smelting Furnace Co.**, Belleville, Ill.



For More Details Circle No. 453—Page 39

CONTROLLABLE VIBRATORS

Pneumatic vibrators are controlled by adjusting impact and frequency. An adapter unit is used with the vibrator (see illustration) to control input of compressed air. A 1¼-in. model produces 2400 vpm at a starting and stopping pressure of 3 psi and 6200 vpm at 80 psi. A 3-in. model produces 980 vpm at 3 psi and 6000 vpm at 80 psi. The smaller vibrator weighs 9 lb, and the larger model weighs 43 lb. Each model features all-steel construction, O-ring static seals, rubber shock absorbers, and safety clips on all bolts.—**Branford Co.**, 130 Glen St., New Britain, Conn.



For More Details Circle No. 454—Page 39

WET BLAST UNIT

Wet blast unit, Model AA-77, and work handling table are designed for wet blast finishing of diecasting dies and pieces too large and unwieldy to be handled in smaller machines. The operator directs the abrasive-water mixture from the aspiration-type blast gun by looking through the rubber-gasketed viewing window, which features a fluorescent light and window washing device. The cabinet, which is 70 in. wide, 70 in. deep, and 108 in. high, is fabricated

of 304L stainless steel. Two counterweighted loading doors provide access areas 54 by 56 in.

The work handling table is 75 in. wide, 60 in. deep, and 30 in. high to the top of the rails. It consists of a rotary table mounted on a carriage for moving work pieces in and out of the blasting cabinet and for rinsing after cleaning. The table is plastic-coated expanded metal and it will hold weights up to 3000 lb.—**Pressure Blast Mfg. Co.**, 27 Pleasant St., Manchester, Conn.

For More Details Circle No. 455—Page 39

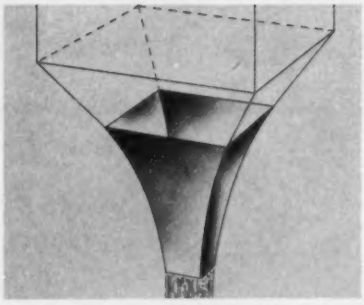
HEAT REFLECTING GLASS

Infrared heat reflecting glass has a special metallic oxide coating on its surface which increases its ability to reflect intense heat and protect personnel and equipment while maintaining full visibility. It is available in 24 x 24-in., 24 x 36-in., and 24 x 48-in. sizes or multiples of these.—**Swift Glass Div., Swift Lubricator Co.**, Elmira, N. Y.

For More Details Circle No. 456—Page 39

BIN OUTLET

Hyperbolic bin outlet is said to eliminate bridging, rat-holing, and erratic flow of bulk materials from bins and hoppers. The outlet is not an attachment since it replaces



the lower section of a conventional hopper and becomes an integral part of it. It is said to eliminate need for vibrators and other attachments presently used to increase flow of bulk materials from bins.—**Bin-Dicator Co.**, 13946 Kercheval Ave., Detroit 15, Mich.

For More Details Circle No. 457—Page 39

EPOXY STRAIN GAGE CEMENT

Epoxy cement B-3 is for attaching strain gages to test pieces. Setting time is three hours at room temperature, but this period can be shortened by application of heat. Temperature limits are 200° F (static) and 250° F (dynamic). The material can be applied to practically any surface, smooth or rough. —**Instruments Div., Budd Co.**, P. O. Box 245, Phoenixville, Pa.

For More Details Circle No. 458—Page 39

150-Curie Radiography Unit Is Portable

Model 520 mobile cobalt unit features a 150-curie source and can be used for directional or panoramic inspection of heavy sections. The model is designed as a directional unit which can be adapted for panoramic use simply by removing a plug in the source container and adding guide tubes. The source then can be cranked out by remote control. Safety locks and warning lights insure complete safety.

The unit is available either in a hydraulic mount or an A frame. The balanced sourcehead can be swiveled from a vertical position downward to 45 degrees above horizontal and firmly locked at any angle. The radiation beam can be aimed downward while the sourcehead is any place from 4 to 68 in. above the floor. Horizontal beam work can be per-

formed when the head is between 9 and 70 in. above the floor.—**Picker X-Ray Corp.**, 1275 Mamaroneck Ave., White Plains, N. Y.

For More Details Circle No. 489—Page 39

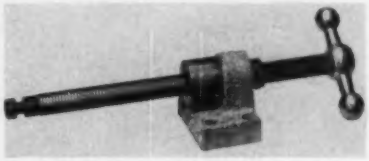
TRAMP IRON SEPARATOR

Self-cleaning tramp iron separator is designed for suspending over conveyors, chutes, or spouts, and is available with magnet strengths for conveyor belt to cross belt heights of 2, 2½, and 3 in. New features include a plate to deflect conveyor burden surge from cross belt; permanent magnets; enclosed gear head, motor, and drive; nonmagnetic belt facing and cleats; and unitized construction.—**Dings Magnetic Separator Co.**, 4740 W. Electric Ave., Milwaukee 46, Wis.

For More Details Circle No. 459—Page 39

PRESSURE UNIT

Pressure unit is for use as a clamping component in jigs, fixtures, and other clamping operations. A push-pull lock and release requires only a twist of the handle to lock



or unlock it. The standard unit is suitable for clamping ranges up to 8 in. It is furnished with a plain soft end for machining and adapting to any application.—**Universal Vise & Tool Co.**, Parma, Mich.

For More Details Circle No. 460—Page 39

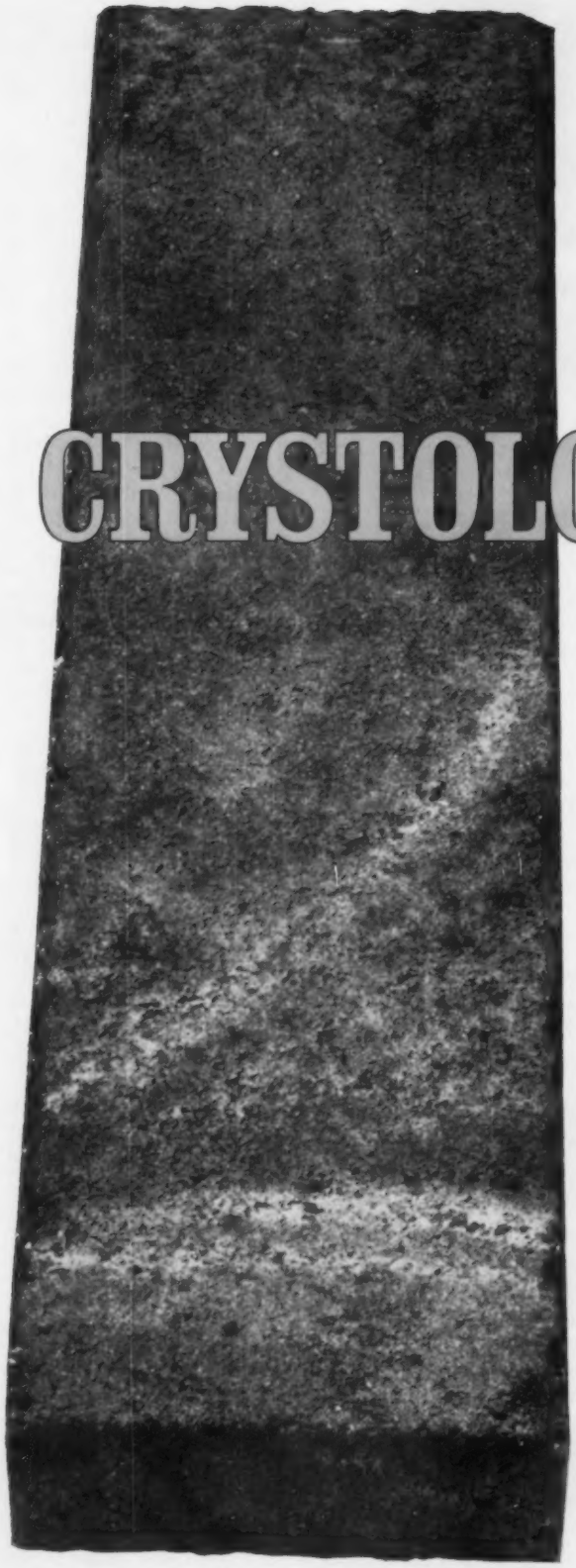
MASTER ALLOYS

Master alloys, in 2 to 4-oz sizes, are to be added to remelt and primary aluminum. Additives available are for raising contents of titanium, chromium, manganese, and boron. In addition, special mixtures and custom alloys can be provided.—**Howe Refining Corp.**, division of Howe Sound Co., Sewaren, N. J.

For More Details Circle No. 461—Page 39

SAND ADDITIVE

New sand additive, called X-Pan-Trol, is said to eliminate rat-tails, buckles, and scabs. It is for use with both synthetic and naturally bonded sands for production of ferrous and nonferrous castings. Used as a direct addition to the green heap or green facing sand in amounts not larger than 1 per cent of total sand weight, the material is intended to increase mold hard-



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NORTON PRODUCTS: Abrasives • Grinding Wheels • Machine Tools • Refractories • Electro-Chemicals — BEHR-MANNING DIVISION: Coated Abrasives • Sharpening Stones • Pressure-Sensitive Tapes

ness and eliminate usual sand expansion defects. It has been used to replace skin drying for control of surface defects, and also has been employed to substitute a green ram-up core for a baked core.—**Whitehead Bros. Co.**, 324 West 23rd St., New York 11, N. Y.

For More Details Circle No. 462—Page 39

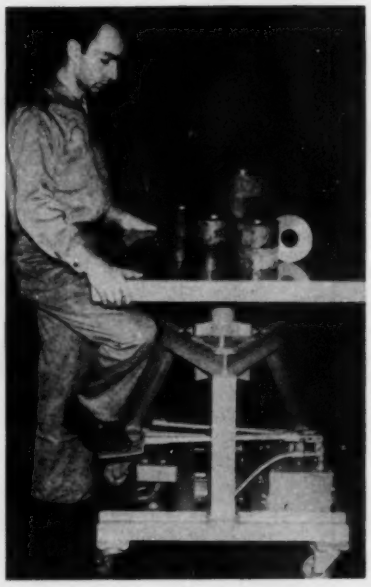
WELDING REGULATORS

New line of welding and cutting regulators, the 400 Series, combines the sensitivity and performance of a two-stage regulator with the simplicity and economy of a single valve. The single balanced valve prevents outlet pressures from being affected by variations in inlet pressure, and it will not flutter or vibrate even when full cylinder pressure is suddenly applied with the pressure adjustment turned to maximum. Maximum flow capacity is provided by elimination of extra valving.—**Kim Products Inc.**, P. O. Box 1288, Lexington, Ky.

For More Details Circle No. 463—Page 39

PORTABLE ELEVATING TABLE

Portable hydraulic elevating table, Model 12 MP 2, is designed to move loads such as dies and castings which are too heavy for a man to carry, but too light to require a crane. The 30 x 30-in. table can be used to lift 2000 lb from a minimum height of 27 in. to a maximum of 44 in. Features include a dual-speed hydraulic foot pump, a foot-operated lowering valve, a floor lock, and welded construction.—**Barworth Inc.**, 681 Morris Turnpike, Springfield, N. J.



For More Details Circle No. 464—Page 39

ELECTRIC VIBRATORS

Electric external vibrators feature a shorter shaft between bearings to reduce bearing strain and minimize bend in the shaft at high speeds. Three sizes are available ranging from 500 to 1400-lb impact, all of which are designed to fit bins, chutes, and screens. They also come equipped with holders for attachment to hopper bottom railroad cars. All units are enclosed, with adjustable eccentrics, and are said to be noiseless.—**Tremix Co.**, 94 Henry St., Binghamton, N. Y.

For More Details Circle No. 465—Page 39

SAND BINDER

Self-Set is a new air-setting binder which cures cores and molds at room temperature. By varying the amount of catalyst, which is added to the resin, and adjusting it to the sand and prevailing temperature, forming cycles can be varied from minutes to hours. Moderate bench lives—in excess of 30 minutes—are recommended, also that cores and molds be formed as quickly as possible, to obtain maximum strength. Quick sets are obtainable but require more rigid control of mixing, mulling, and forming, to avoid loss of binder strength in the muller.

Where large work is involved, half as much catalyst often is used, thereby providing a bench life in excess of one hour. This practice often permits the core or mold to set overnight, so that the stripping and setting time is not critical.—**Para Products Div., Foundry Rubber Inc.**, 5200 River Rd., Washington 16, D. C.

For More Details Circle No. 466—Page 39

WIRE ROPE

Wire rope is made of seven strands plus an independent wire rope core. It is said to combine the best features of six and eight-strand wire rope. Sizes offered are ½ to 1⅛ in., ranging in strength from 13.1 to 64.2 tons.—**Macwhyte Wire Rope Co.**, Kenosha, Wis.

For More Details Circle No. 467—Page 39

ALUMINUM ALLOY

Aluminum casting alloy, available in two grades, contains no silicon and is self-aging. Precedent 71A in as-cast condition has 36,000 psi yld str and some degree of shock resistance. When it has been solution heat treated and aged to the T6 condition, it has over 40,000 psi yld str and over 5 per cent elongation. Precedent 71B has 32,000

Attachment Cures Shell Cores From Inside

Automatic attachment directs a controlled hot air blast into a shell core cavity after investment and during the curing cycle. The shell is cured from the inside as well as from the outside, resulting, it is claimed, in stronger, lighter, and thinner shell cores with 30 per cent less resin and at a 25 per cent higher production rate.

The attachment is pneumatically operated and is timed as a part of the coreblower's automatic cycle. The unit is designed for the company's coreblower Models U-180, U-180-M, and U-360.

It is recommended for shell cores with blow openings of 2 in. or greater and provides controlled temperatures up to 800° F. —**National Acme Co., Shalco Div.**, 170 E. 131st St., Cleveland 8, Ohio.

For More Details Circle No. 490—Page 39

"ROYERATED" SAND IS THE FINEST BLENDED AND AERATED SAND YOU'LL EVER SEE!

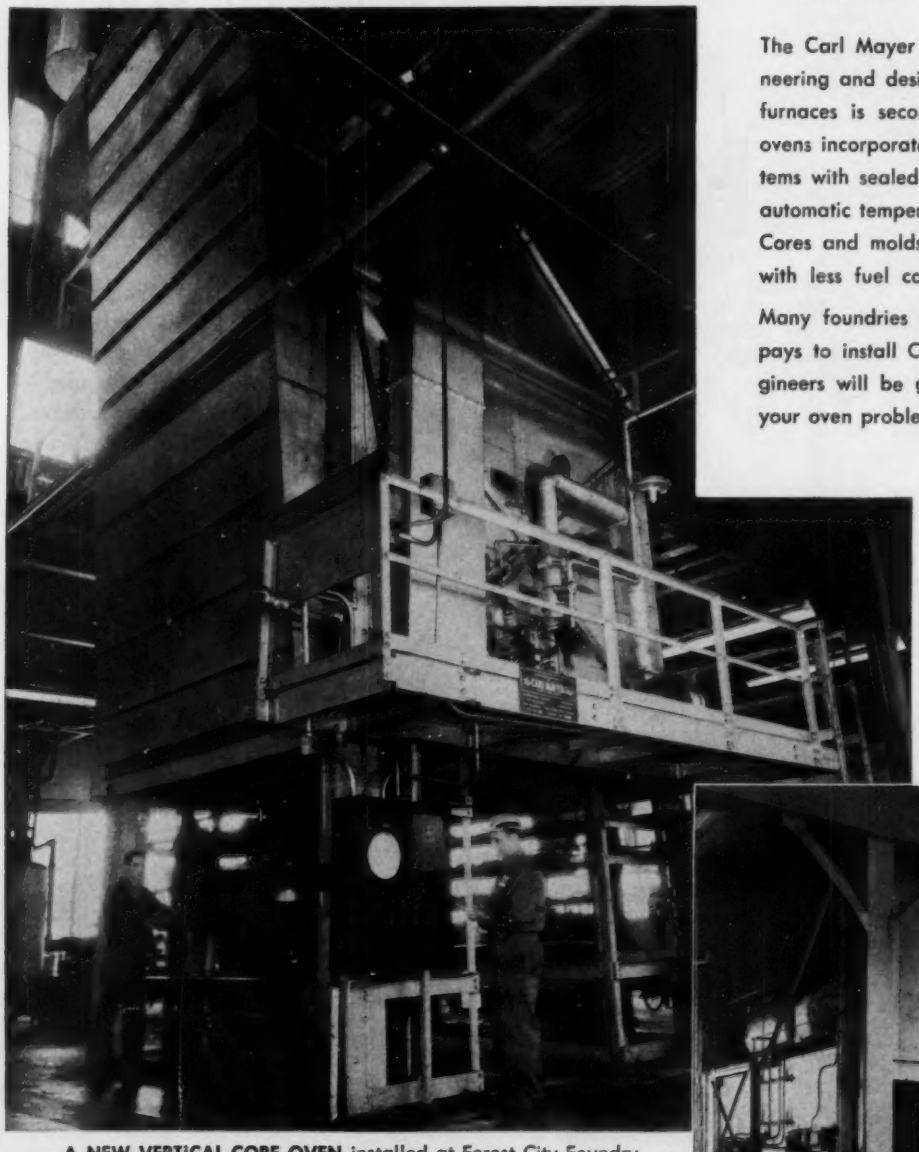
You're looking at the "business" end of a machine that for some 40 years has given foundrymen everywhere the best in blended and aerated sand. SAND SEPARATORS AND BLENDERS use a unique "combing belt" principle (we call *Royeration*) that combines combing of the sand with thorough churning, mixing and cooling. These machines—for any size foundry—available as portable or stationary, hand-shovel, tractor-bucket feeding or mechanized "in-line" installations. Capacities from 4 to 180 tons/hour. *New bulletin #SS-60 tells all.* Get all the specs, facts by contacting us. Royer Foundry & Machine Co., 159 Pringle Street, Kingston, Penna., phone BUtler 7-2165.

For More Information Circle 598, Page 39

ROYER

ROYER FOUNDRY & MACHINE CO.

Foundry-Proven Money Makers!
Ovens Designed by carl mayer CORP.

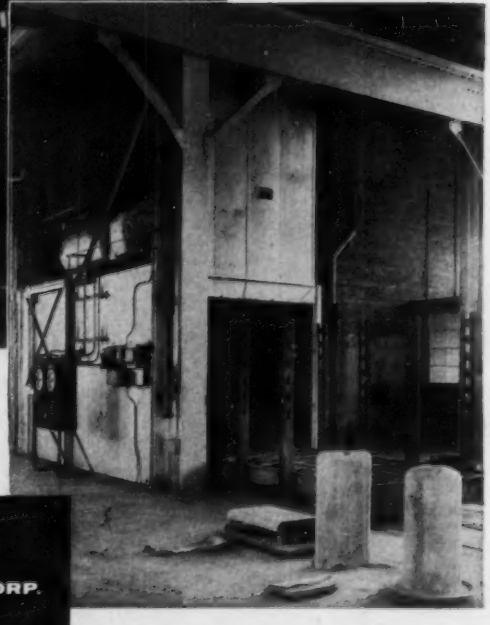


The Carl Mayer Corp. experience in engineering and designing industrial ovens and furnaces is second to none! Carl Mayer ovens incorporate recirculating heating systems with sealed combustion chambers and automatic temperature controls for all fuels. Cores and molds are evenly baked faster, with less fuel consumption.

Many foundries of all sizes have found it pays to install Carl Mayer ovens—Our engineers will be glad to work with you on your oven problems. Write or call now!

Write for Bulletin 53-CM

A NEW VERTICAL CORE OVEN installed at Forest City Foundry, Cleveland, Ohio. Size is 12' 7" x 11' 10" x 57' 8" high above floor. 29 carriers, 3 shelves high; each shelf 30 x 106 inches. Features forced cooling and exhaust system for uniform cooling of cores before unloading.



CAR TYPE MOLD OVEN at American Brake Shoe Co. features under floor chain car puller. Size 10' x 10' x 19' long.

THE carl mayer CORP.

20800 CENTER RIDGE ROAD CLEVELAND 16, OHIO

OTHER PRODUCTS: Heat Treating Ovens and Furnaces • Rod Bakers • Welding Rod Ovens • Paint and Ceramic Drying Ovens • Special Processing Equipment and Accessories

psi yld str and 7 per cent elongation in the as-cast, fully aged condition. Both grades can be stress relieved at 700° F after which they remain dimensionally stable within 0.00001 in. per in. Both grades require no stress relieving during or after machining. They can be furnace or dip brazed at temperatures up to 1125° F and can be polished or anodized.—**William F. Jobbins Inc.**, Aurora, Ill.

For More Details Circle No. 468—Page 39

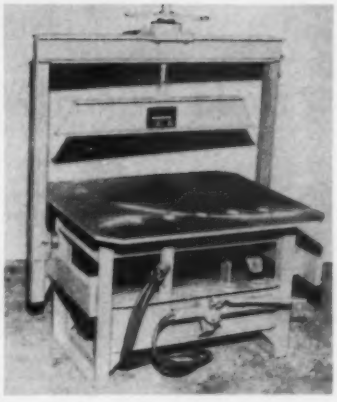
SAFETY GLASSES

Line of safety glasses now features a seven-barrel hinge which is 40 per cent stronger than the five-barrel type used in the past. A special temple screw assembly prevents screws from falling out. Other features include saddle bridge, optional side shields, a wide choice of temple styles, and a choice of pink crystal, smoke, or mahogany frame colors.—**American Optical Co., Safety Products Div.**, Southbridge, Mass.

For More Details Circle No. 469—Page 39

HYDRAULIC PRESS

Hydraulic press is claimed to be useful for increasing flask life up



to 50 per cent. It can be used to straighten sand joints, to replace worn bushings and pins, and to correct corner angles. Also, warped core plates and bent flasks are straightened easily. Four standard sizes are offered and others can be designed to meet special requirements.—**Dace Industries Ltd.**, 504 Victoria Ave., Windsor, Ont.

For More Details Circle No. 470—Page 39

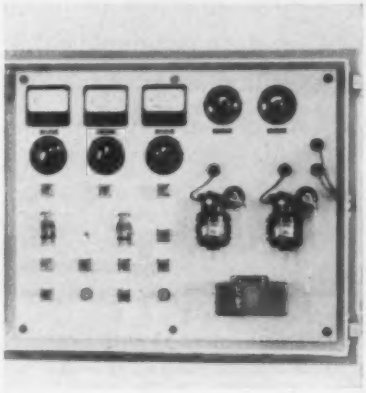
TAKEUP FRAMES

Multibearing takeup frames, available in 11 sizes, are designed to accommodate any type of bearing in any two-bolt pillow block with mounting holes up to $\frac{5}{8}$ in. Units allow horizontal bearing adjustments from 6 to 24 in. Mounting pads adjust to the mounting holes in the pillow block and mounting bolts, furnished with each frame, are zinc-plated. Frames are steel channels attached to mounting feet to form a rigid box frame. Large diameter adjusting screw is zinc-plated for protection against rust.—**Link-Belt Co.**, Prudential Plaza, Chicago 1, Ill.

For More Details Circle No. 471—Page 39

SAND BOND COMPENSATOR

New device, called a Bond Compensator, automatically varies the amount of bond added to the sand



mixture according to the temperature and moisture of the return sand in the batch hopper. A simple dial adjustment in the controller gives the strength level required.

Uniform green strength is said to be maintained regardless of the type of work running on the production line. Each bond addition is made according to the requirements of the particular batch, and the bond is accumulated in the bond hopper for the next batch of sand. Automatic operation takes the human element out of bond addition to provide a consistent sand quality.—**Hartley Controls Corp.**, Neenah, Wis.

For More Details Circle No. 472—Page 39

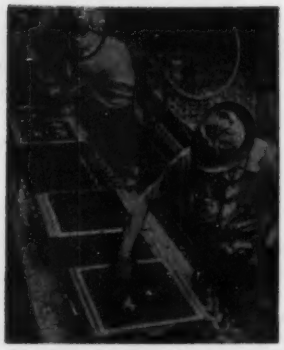
INDUSTRIAL TRUCK BATTERY

Type TSC batteries are offered with an electrical capacity of 85 amp-hr per positive plate. They are said to have more capacity per cubic inch, enabling them to save on cost per amp-hr and permitting trucks to work harder, longer shifts with less

Swing Frame Grinder Features 5-hp Motor

Swing frame grinder is said to be suspended in perfect balance, and it has a convenient three-handle arrangement so it can be maneuvered easily into grinding position. It is powered with a 5-hp, 3600 rpm motor to drive resinoid wheels at 9500 sfpm. The spindle will accommodate grinding wheels 7 in. in diam or 10 in. in diam by 1 in. face width by 1 in. bore.—**Grinding & Polishing Machinery Corp.**, 2530 Winthrop Ave., Indianapolis 5, Ind.

For More Details Circle No. 491—Page 39



SETTING CORES IN DRAG HALVES as molds are conveyed to next station. Except for core setting and pouring, this new line is completely self-operating for continuous production flow.

Osborn Field Report...

HERE'S WHAT'S HAPPENING ON THE MOST PRODUCTIVE MOLDING LINE IN THE U. S.

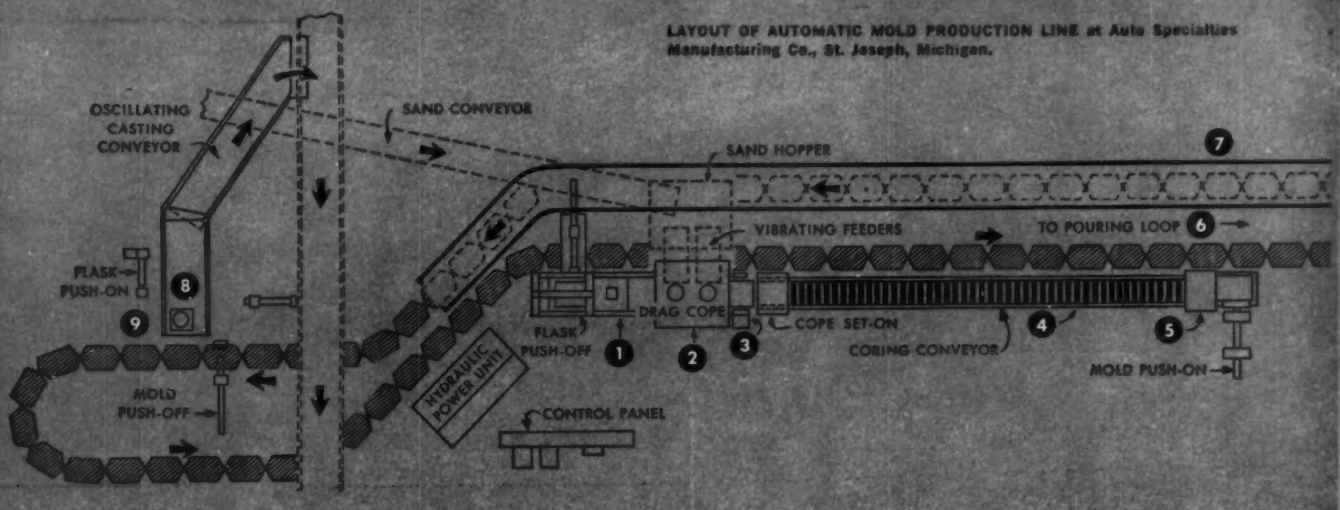
This new automatic molding line at Auto Specialties Manufacturing Co. ranks today as the nation's most productive, dependable molding operation. It features Osborn's Automatic Series "M" Molding Machine plus other Osborn-built automatic equipment for highly efficient mold and flask handling. Requiring only a minimum of manpower, its simplicity enables the new setup to run dependably hour-after-hour...shift-after-shift, turning out a continuous flow of exceptionally high quality castings of close dimensional accuracy and superior surface finish. Net result is that workers like the new line and so does management. It's on-the-job evidence that the *key* to modern foundry *profit* planning is *mechanization.*

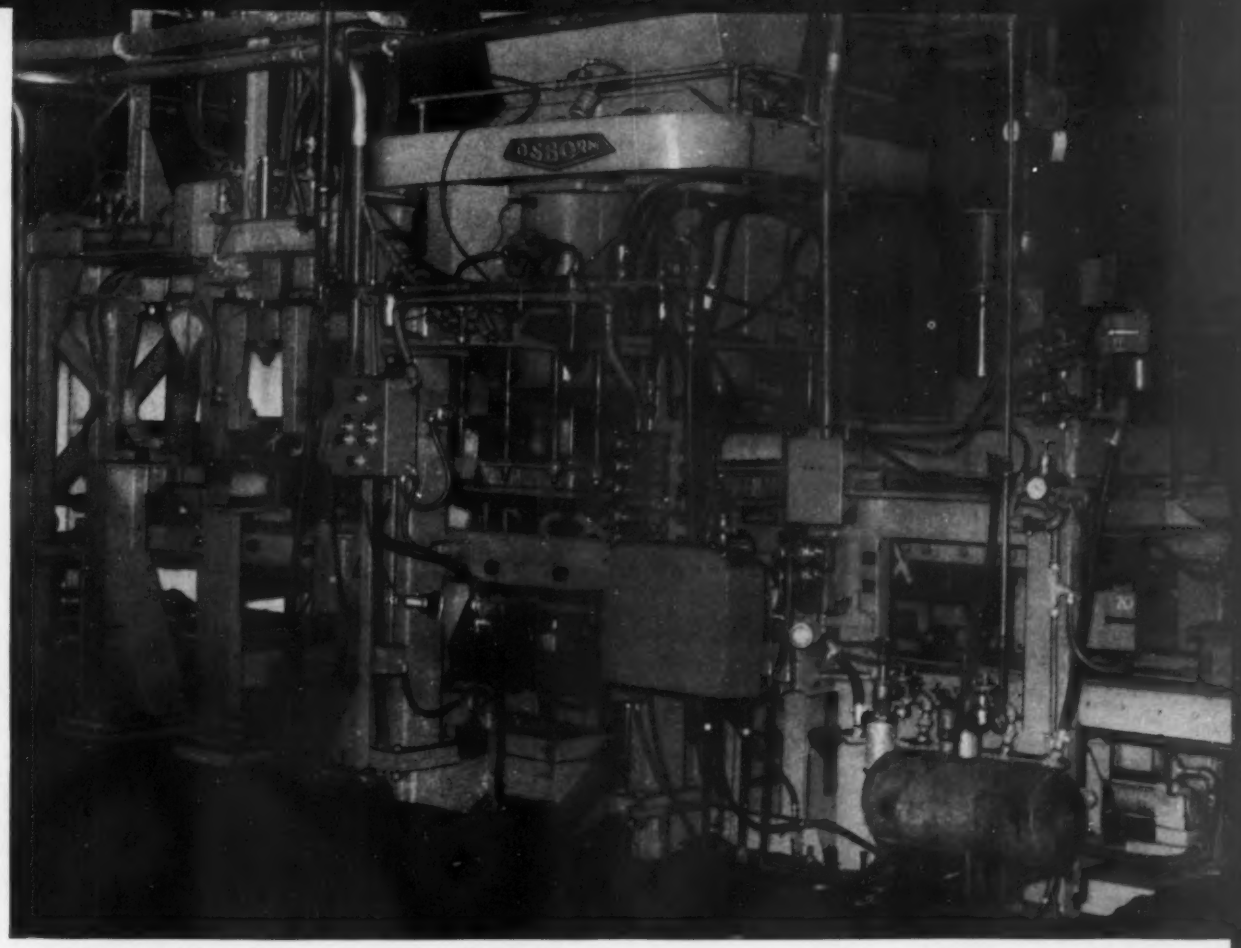
For foundrymen concerned with ways to lower costs...speed production...boost efficiency on short-run or mass production—Osborn's advanced foundry production machinery and methods are well worth checking into. Write for full information.

Osborn equipment at Auto Specialties Mfg. Co. delivers these 6 important benefits: Higher production is achieved with minimum manpower • All jobs carry the same standard rate • Variations in mold types are handled by simply varying number of core setters and pourers • Mold hardness can be changed by simple adjustments • Sand spillage is practically eliminated...reducing "housekeeping" time • No manual lifting...less exposure of workmen to injury.

HERE'S HOW IT WORKS—Assembled flasks are pushed from closed-loop conveyor car line into flask feeder at (1). Cope and drag are automatically separated and positioned in molding machine (2) for blow-fill and squeeze. As mold halves are ejected from molding machine, drag is rolled over at (3). Cores are set at (4) and molds enter closing machine at (5). Pouring is done at (6). Filled flasks move through cooling tunnel (7) to automatic punch-out station at (8). Cycle is completed as empty flasks are returned to conveyor at (9). Flasks used on the line measure 16" x 19" x 8" drag, 8" cope. Molds are rammed to a uniform hardness of 90-97 depending on job requirements.

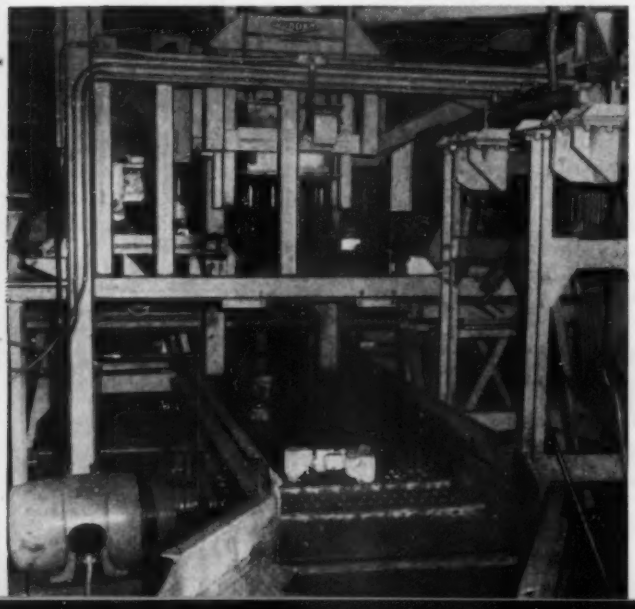
LAYOUT OF AUTOMATIC MOLD PRODUCTION LINE at Auto Specialties Manufacturing Co., St. Joseph, Michigan.





COPE AND DRAG MOLDS ARE RAMMED SIMULTANEOUSLY at a rate well over 300 per hour by Osborn Series "M" Blow-Squeeze Molding Machine on new automated molding line at Auto Specialties Manufacturing Co. Finished half molds are seen moving out of machine at right. Series "M" Molding Machines (available in 3 size ranges) are blow-fill, hydraulic-squeeze units. Entire molding sequence is automatic, on pre-set time cycles. Green sand molds are completed within 12 seconds.

OSBORN AUTOMATIC CASTING PUNCH-OUT EQUIPMENT quickly removes sand and castings . . . brushes flask walls clean . . . and eliminates practically all flask pin and bushing maintenance.



FOREIGN REPRESENTATIVES — *ARGENTINA: EISA Argentina, Buenos Aires. BELGIUM: S. A. Isbecque Todd, Brussels. BRAZIL: Equipamentos Industrias EISA, Ltd., Sao Paulo. BRITISH ISLES: J. W. Jackman & Company, Ltd., Manchester. FRANCE, ITALY: S.A. des Machines Osborn, Paris. MEXICO: Forel De Mexico, S. A., Mexico, D.F. THE NETHERLANDS: Landre & Glinderman, NV, Amsterdam. SWEDEN: S. Alexanderson & Company, A/B, Sodertalje. SWITZERLAND, FED. REP. OF GERMANY: APROTEC, S.A., Geneva. BOLIVIA: International Machinery Co., LaPaz. CHILE: International Machinery Co., Santiago. PERU: International Machinery Co., Lima.*

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Molding Machines
Shell Core Machines
Core Blowers
Metal Finishing Machines
...and Finishing Methods
Industrial Brushes

OSBORN®

FEMA

For More Information Circle 600, Page 39

frequent battery charging. Batteries are designed for use in many types of counterbalanced and stand-up, center-control and end-control fork lift rider-type trucks, and in pallet-type and fork lift hand trucks. All batteries have an over-all height of 22⅝ in. and are available in 11 standard sizes with from 11 to 33 plates per cell in capacities ranging from 425 to 1360 amp-hr.—**Exide Industrial Marketing Div., Electric Storage Battery Co.,** Rising Sun and Adams Avenues, Philadelphia 20, Pa.

For More Details Circle No. 473—Page 39

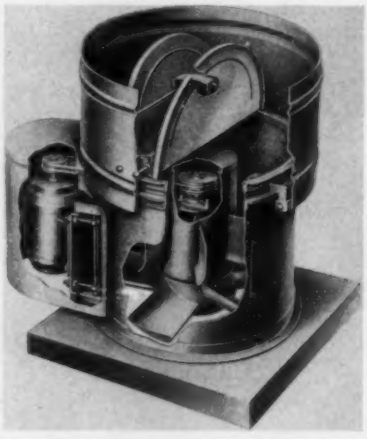
DISPOSABLE SWEATBANDS

Disposable sweatband of white gauze and cotton is claimed to hold up to ten times its weight in moisture and to be cool, light, and comfortable.—**General Bandages Inc.,** Morton Grove, Ill.

For More Details Circle No. 474—Page 39

ROOF VENTILATORS

Roof ventilator line consists of 20 models, each with a fan belt driven by a motor mounted in a weatherproof housing outside the gas stream. Rigid motor supports are welded to the outside of the ventilator casing, and belt tension can be readily adjusted. Features include all-welded construction; sealed self-aligning bearings; nylon damper



hinge bearings; weatherproof motor housings; hinged discharge; and leakproof, lightproof dampers. Corrosion-resistant metals or special protective coatings are available. Free air capacities offered range from 2000 to 60,500 cfm.—**L. J. Wing Mfg. Co.,** 2300 N. Stiles St., Linden, N. J.

For More Details Circle No. 475—Page 39

DRY LUBRICANT

Dri-Slide is a lubricant consisting of molybdenum disulfide carried in light petroleum hydrocarbons. It is said to provide dry, dust-free lubrication and is claimed to be effective as a penetrant and as a rust preventive. It is offered in 8-oz cans, but larger container sizes can be ordered. —**Bux Dri-Slide,** Fremont, Mich.

For More Details Circle No. 476—Page 39

PROCESS CONTROLLER

Batch process controller with punched card programming is designed to shorten batching time, produce a uniform product, reduce waste, and increase production of standard batch processing machinery. It controls factors such as loading and filling; temperature, speed, and pressure changes; and timing. A hand punch is used to make the required holes in the plastic program cards according to sim-

compare

LIFT TRUCKS

Power and Performance

Allis-Chalmers' OWN — POWER-CRATER engine is engineered specifically for Allis-Chalmers lift trucks. Has unique crater-shaped combustion chamber that sets up violent swirling turbulence for thorough mixture of air and fuel, resulting in responsive power and maximum fuel economy.

Operator Effectiveness

Familiar, automotive-type controls — wide, adjustable seat — unobstructed floor — these and many other conveniences help operators work faster, safer.

Accessibility

Service and maintenance in a minimum of time.

Versatility

Masts, carriages, forks and attachments to fit the job — constant-mesh, two-speed transmission or POWER SHIFT torque converter drive — choice of fuel and tires. New special-purpose trucks, with high underclearance and quickly removed counterweight, in 6,000, 7,000 and 8,000-lb capacities.

ALLIS-CHALMERS

ple rules; consequently no special training is necessary for programming. After a formula has been translated to holes in a card, the card can be reused indefinitely. Each controller is built for a particular application from modular components.—**Control Equipment Corp.**, 19 Kearney Rd., Needham Heights 94, Mass.

For More Details Circle No. 477—Page 39

AIR PRESSURE GOVERNOR

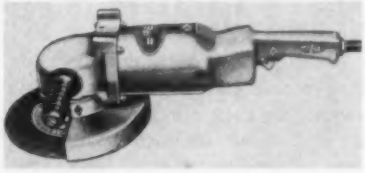
Governor maintains receiver pressure within 1 lb of any setting while a compressor is operating by maintaining the motor load in direct proportion of the air demand, resulting in a lower over-all load factor. The unit can be installed on any compressor using conventional regulating equipment and unloading inlet valves. Multistage compressors require a governor for each stage.

Pressure adjustment is made by a simple screw setting. Standard units are designed for 150 psi, and others for higher pressures can be built to specifications. Each governor has only one self-actuated moving part and requires no internal adjustments, cleaning, lubrication, or other maintenance.—**Trymac Corp.**, 16 W. 5th St., Erie, Pa.

For More Details Circle No. 478—Page 39

ELECTRIC GRINDER

Nine-in. heavy duty electric grinder, Model 1270, is intended for



heavy grinding or sanding of large areas. It is designed for use with a 6 x 4¾ x 2-in. flared cup wheel, a 9-in. depressed-center wheel, 6-in. cup wire brush, or 9-in. sanding disc, and features a momentary switch. It operates at 5000 rpm and draws 13 amp at 115 v.—**Albertson & Co.**, Sioux City, Iowa.

For More Details Circle No. 479—Page 39

CARBON CUTTING RODS

Carbon cutting rods are offered for pad washing, cleaning cracks, and cutting off fins with an electric arc and compressed air. They are designed so that the tapered end of a new rod will fit into a tapered hole at the end of a rod stub and be held by friction. This construction permits the stub to be used up without damaging the torch. The rods are electroplated with copper except for the tapered sections. They come in 12-in. lengths in diameters of ½, ⅝, ¾, and 1 in.—**Speer Carbon Co.**, St. Marys, Pa.

For More Details Circle No. 480—Page 39

X-RAY FILM CARRIER

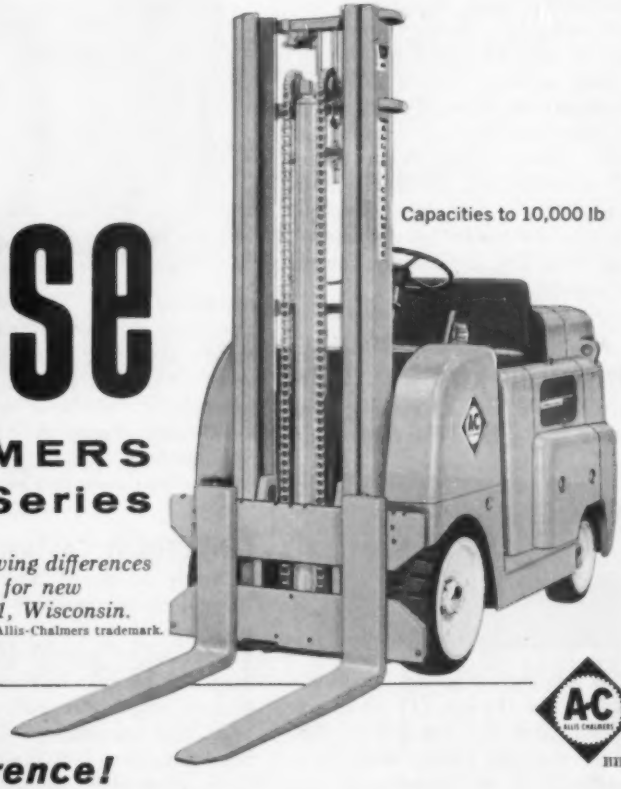
X-ray film carrier prevents fogged and crimped edge films. It is light-tight, lightweight and low cost. Finish is a durable, stain-resistant plastic. Carrier will hold a complete 75-sheet interleaved or 150-sheet noninterleaved package of the company's film and can be used to hold unexposed film, to take film to an outside job, to carry film between loading and processing rooms, and to store processed film. It is available in sizes including 14 x 17 in.,

and you'll choose

ALLIS-CHALMERS "F" Series

Have your dealer show you the many dollar-saving differences in Allis-Chalmers "F" Series lift trucks. Ask for new bulletin BU-680. Allis-Chalmers, Milwaukee 1, Wisconsin.

POWER-CRATER is an Allis-Chalmers trademark.



Capacities to 10,000 lb

. . Lift Trucks with the Dollar-Saving Difference!

A-C ALLIS-CHALMERS

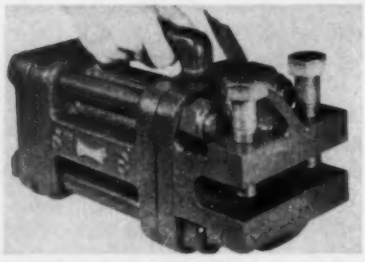
HH-180

10 x 12 in., 8 x 10 in., and 7 x 17 in.—**Ansco Div., General Aniline & Film Corp.**, 33 Charles St., Binghamton, N. Y.

For More Details Circle No. 481—Page 39

VIBRATOR CLAMP

Vibrator clamp mounts the company's 3-in. LSF-VG portable air vibrator on small or narrow areas



of bins, trucks, railroad cars, or core boxes. Two ¾-in. bolts provide the clamping pressure. The unit will fit areas as small as 2¾ in. deep by 6 in. wide and up to 1 in. thick.—**Cleveland Vibrator Co.**, 2828 Clinton Ave., Cleveland 13, Ohio.

For More Details Circle No. 482—Page 39

MOISTURE CONTROLLER VALVE

Valve automatically and continuously eliminates water and oil condensation from compressed air lines without causing pressure drop. It can be added to existing air lines without cutting them by attachment to filter bowls, drop legs, aftercoolers, and compressor points. Unit is just under 6 in. long and 1¼ in. in diam; it is threaded to fit ¼-in. pipe. Special sizes can be made on request.—**Barger Mfg. Co.**, 204 Foshay Tower, Minneapolis 2, Minn.

For More Details Circle No. 483—Page 39

BELT SPLICING KITS

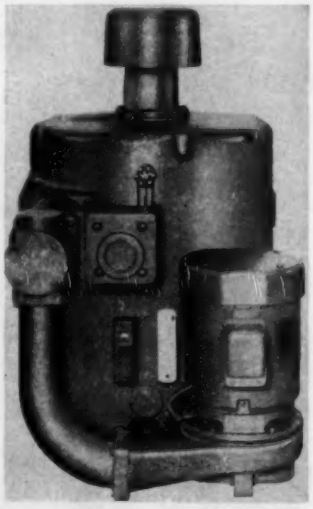
Kits enable user to make splices in belts in 1½ hr. The three steps

in the splicing operations are illustrated. From the left, (1) plates are attached after the removal of the rubber cover, (2) rubber filler stock is applied over the plates, and (3) a rubber cover is cold vulcanized to the belt surface. The result is said to be a joint that prevents fabric rot due to moisture, a cleaner scraper operation, and elimination of wear on idler rollers.—**Crescent Belt Fastener Co.**, 381 Fourth Ave., New York 16, N. Y.

For More Details Circle No. 484—Page 39

VACUUM PUMP

Vacuum pump is said to be practical where hot gases, condensable vapors, or even slugs of liquid are present in air handled. The unit can be used as a combination air pump and direct contact condenser, as a liquid scavenger, or as a combination vacuum-condenser-pressure unit. The multijet vacuum producer has no moving parts and requires no internal lubrication or wear adjustment. Nonpulsating suction is maintained without accumulator or



equalizing tanks. Vertical pump design protects motors from surface water and dirt and saves floor space. Controls for the pump are selected for individual applications.—**Domestic Pump & Mfg. Corp.**, Shippensburg, Pa.

For More Details Circle No. 485—Page 39

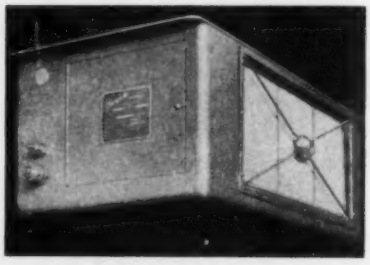
CENTRIFUGAL CASTING UNIT

Newly developed horizontal centrifugal casting machine is equipped with gas burners for preheating molds before initial castings are made. Unit also is equipped with high-velocity water cooling to maintain mold temperature during casting operations. Pneumatic equipment is included to spray lining into permanent molds. Castings also can be produced in sand-lined flasks. Machines are adaptable to high production with automatic controls.—**Design Engineering & Products Co.**, P. O. Box 7466, Tulsa 5, Okla.

For More Details Circle No. 486—Page 39

AIR CONDITIONER

Heavy duty ceiling-type air conditioner, CE 23, cools warm air,

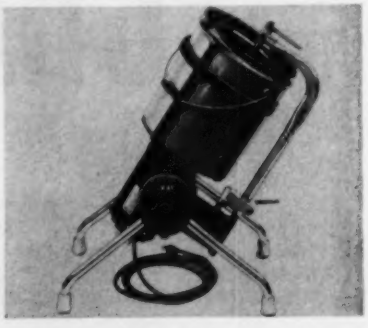


heats cool air, dehumidifies, and filters out dirt, odors, and noxious fumes. The unit will operate at ambient temperatures up to 180° F. All valves, fans, motors, and filters are accessible for maintenance.—**Correct-Air Corp.**, Willoughby, Ohio.

For More Details Circle No. 487—Page 39

PORTABLE MIXER

M-61 portable batch mixer is designed for mixing, stirring, and blending of liquids, powders, granular materials, and slurries. Unit rotates a standard 5-gal drum at 60 rpm against a stationary paddle. A variety of interchangeable paddles is offered, including ones which scrape the sides and bottom of the drum. An adapter to hold 1-gal can also is available. The frame, with permanently lubricated motor,

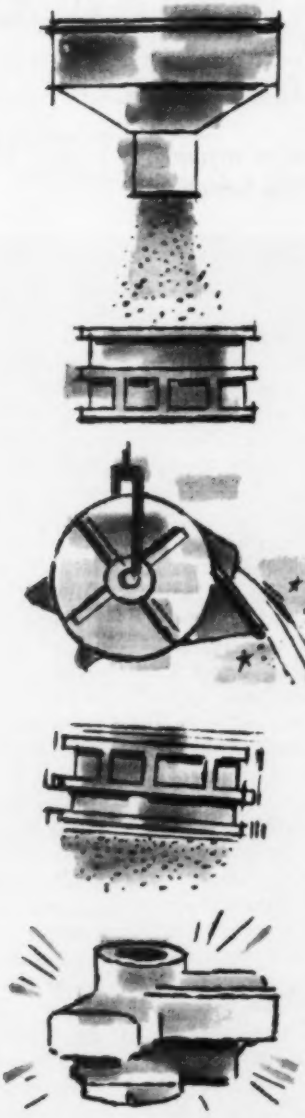


weighs 55 lb complete. The drum carriage can be tilted to any of seven positions for best mixing of materials.—**KOL Inc.**, 2323 Ellis Ave., St. Paul 14, Minn.

For More Details Circle No. 488—Page 39

SAND-MEX®

IMPROVES FLOWABILITY FOR BETTER CASTING RESULTS



IN MULLING
SAND-MEX reduces friction between sand grains, resulting in greater flowability. All the sand in the system can be used. SAND-MEX also reduces wear and abrasion on sand handling equipment.

IN MOLDING
SAND-MEX increases stability of foundry sand; makes possible sharper pattern impressions.

IN POURING
SAND-MEX puts a graphitic film on sand which inhibits chemical and physical reaction, helps eliminate rat-tails, scabs, etc. Expansion and contraction of sand is reduced when metal is poured into the mold.

IN SHAKEOUT
SAND-MEX prevents sand from becoming strongly fused after pouring; it's easily broken down. Shakeout time is thus reduced and casting damage minimized.

BETTER CASTING RESULTS
SAND-MEX makes possible cleaner castings with better color and finish that are truer to pattern. Machining and labor costs are reduced.

For better casting results, use SAND-MEX, available in 50 lb. bags.

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For More Information Circle 602, Page 39

By RALPH L. LEE, *President*
Lee Hobby Foundry, Birmingham, Mich.

Mechanics and Humanics

"Sometimes I wonder whether we are not inclined to be so wrapped up in the mechanics of the job that we lose sight of the humanics"

● ACROSS THE STREET, a concrete bridge is being built over the River Rouge, which is more a creek than a river up where we live. The job is quite a project, however, and about eight men are doing the job —one which would have taken at least three times as many workers when I was a youngster.

By dropping in on this group every day or so, I have learned to know every member of the gang quite well. In fact, we're all close friends. I'd like to explain at this point, incidentally, that I have not neglected my duties in the Lee Hobby Foundry.

Complete Mechanization — My new friends have every conceivable power device and mechanical aid to help them with their work. The crane operator, my special pet, is nothing short of a genius. I honestly believe that by clamping a pencil on one of the teeth which edge the front of his digging bucket, he could write his name—or print it, at least.

With a heavy skull-cracker attachment, he breaks up heavy pavement. He also demolished the old bridge with it. With a hook he sets down big prefabricated concrete forms, right on the line. Everyone stops to watch him as he picks up heavy wooden mats with the same hook and lays them down in front of his treads to serve as a road over the sloppy muck in the river bottom.

With a bottom-dumping bucket attachment, he fills the concrete forms without spilling a bit. The rest of the gang brag about his skill, judgment, and the way he keeps his shirt on in emergencies. But I shouldn't go overboard with my praise for him, for every other member of the gang is equally distinguished at his particular specialty.

Bob, a fine upstanding man, at first appeared to be a general handyman. Now I know that he isn't, for he is a master at finishing concrete surfaces. This bridge has to be good looking—almost monumental, in fact. He manages, without being told, to be on hand when critical adjustments are to be made in a locating operation. He knows the whole project inside and out—where everything is and what's coming next. He confided in me that he's doing a bit of night study on his mathematics.

It's amazing how one of these great big ready mix concrete trucks just happens to pull up exactly at the right time to fill the forms, just finished, with exactly the right number following and with none leaving empty. I haven't seen one wheelbarrow and not more than two hand shovels, which are used only occasionally and then as trowels rather than as conveyors.

Togetherness Does It—The most interesting thing to me, however, is that few words are spoken, and those few are more like grunts. These fellows have developed a sign language through which they seem to communicate rather involved messages.

I don't believe that any one could watch this group in action without concluding that careful, over-all plans and schedules had been made and, more importantly, that every member of the group knows exactly what he is doing and where the crew is on the schedule at the moment. Nor could any sidewalk superintendent dodge the conviction that every member of the group not only had served his apprenticeship, but also had worked with his present associates in the crew for a long time.

The owner of the business—over 70, by the way—has very little to say and doesn't move very fast, but he just happens to be on hand when some one needs answers, and he's all over the place seeing what's going on, how fast, and how well.

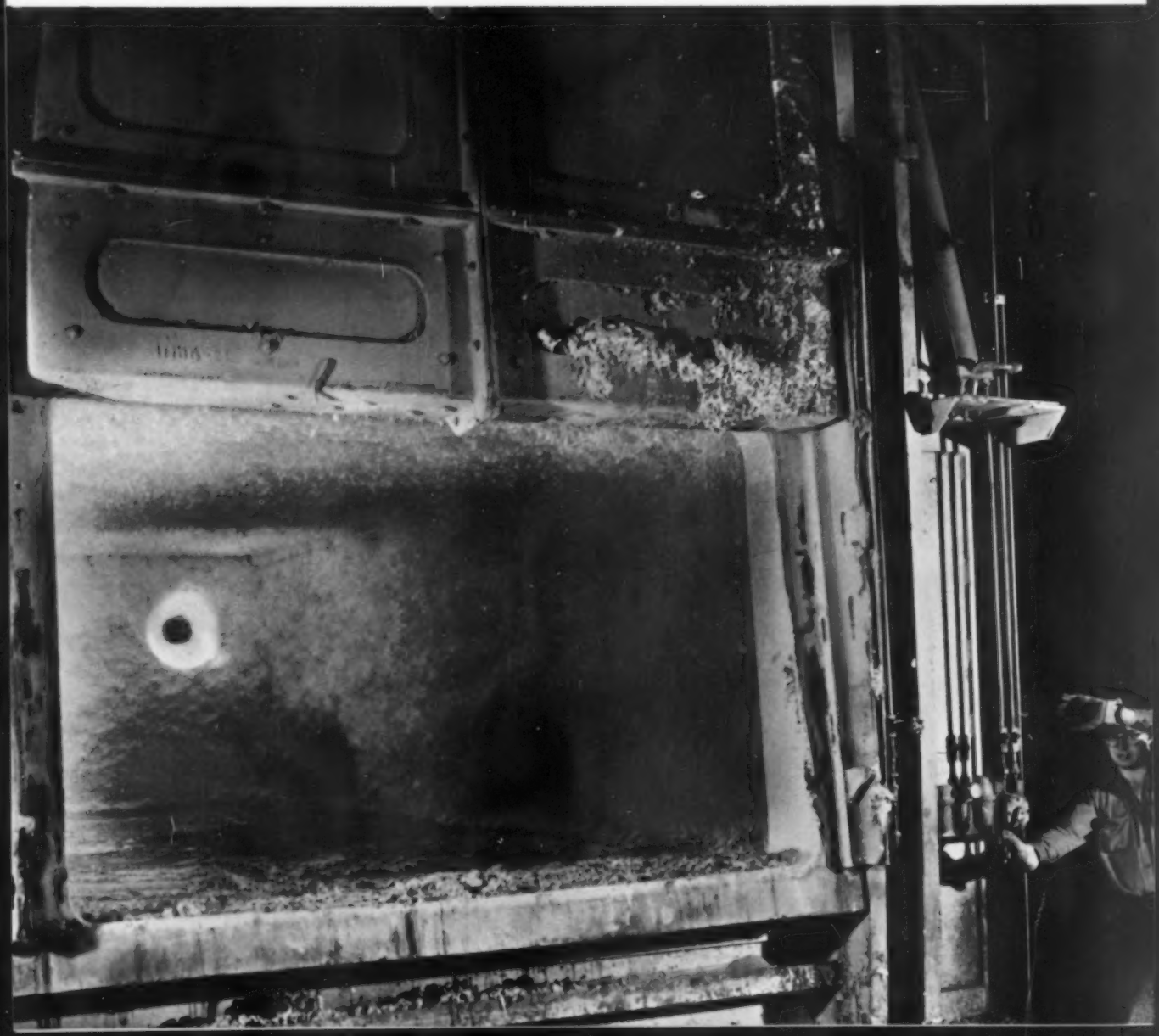
Free and Easy—I've never seen a bunch freer of rank consciousness. They all keep right on doing what they're doing no matter who pops up, and at the same rate. I doubt that they ever drafted an organization chart. Every member of the group has buttonholed me at one time or another to brag a bit about the smooth job one of his pals has done, to ask me how I thought they were getting along or how I liked the looks of what they were doing, or to explain something I didn't understand. They unquestionably are proud of what they are doing.

I began to wonder whether I wasn't gilding the lily a bit in my feeling toward this gang, but the city engineer who serves as an overall inspector of the operation assured

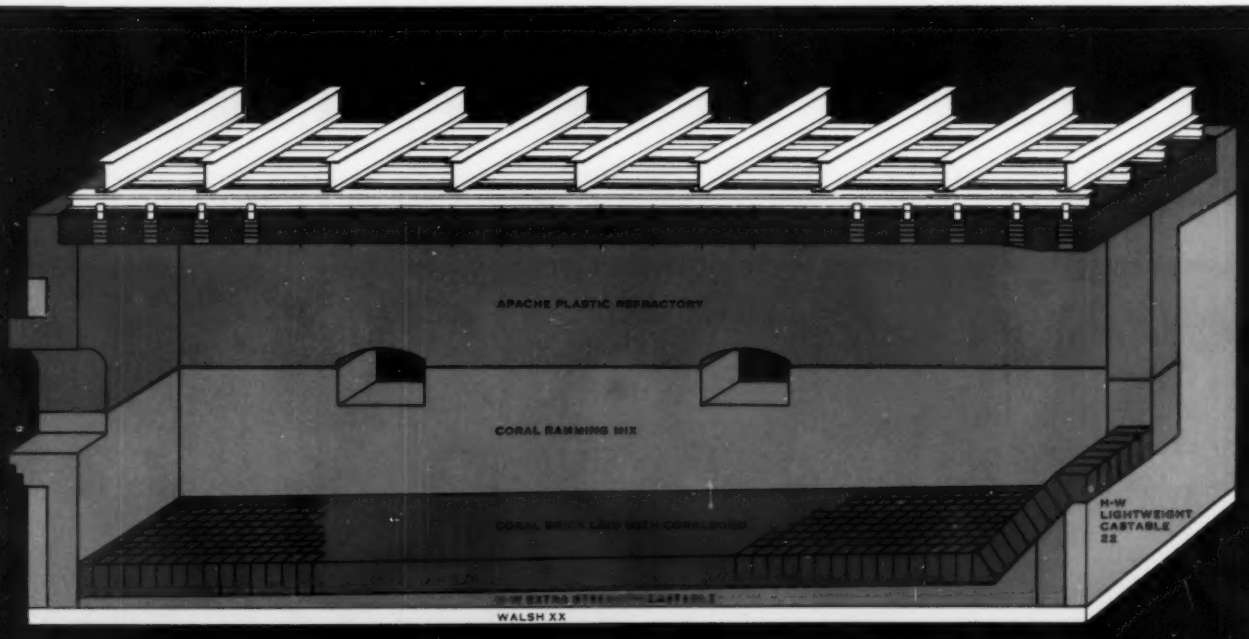
Circle 622, Page 39→

THIS HIGHLY SUCCESSFUL ALUMINUM MELTING FURNACE FEATURING MONOLITHIC CONSTRUCTION WAS BUILT ENTIRELY OF HARBISON - WALKER REFRACTORIES.

Construction and product details are given on the following page. PHOTO: COURTESY OLIN-MATHIESON CHEMICAL CORPORATION



CORAL BRICK, CORALBOND AND CORAL RAMMING MIX WERE ESPECIALLY DEVELOPED BY HARBISON-WALKER FOR ALUMINUM MELTING FURNACES. THEY HAVE ALREADY DEMONSTRATED UNUSUAL RESISTANCE TO PENETRATION AND CORROSION BY ALUMINUM ALLOY REACTION . . . AS WELL AS TO THERMAL SHOCK, SPALLING CONDITIONS, AND SEVERE IMPACT AND ABRASION. THE REFRACTORY USED IN EACH FURNACE SECTION WAS SELECTED TO ASSURE THE BEST BALANCED SERVICE LIFE.



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A strong, power pressed, high duty fireclay brick.

H-W EXTRA STRENGTH CASTABLE

A refractory concrete of outstanding physical strength.

CORAL brick, laid with CORALBOND

These specialized high-alumina brick and mortar have exceptional high strength to withstand spalling and slagging influences, and provide remarkable resistance to molten metal reaction.

CORAL RAMMING MIX

This companion product to CORAL brick and CORALBOND, installed by gunning or ramming, has excellent resistance to molten aluminum alloys and develops great strength at operating temperatures.

H-W LIGHTWEIGHT CASTABLE 22

An insulating monolith.

APACHE PLASTIC REFRACTORY

A high alumina (60%) monolith with refractoriness equal to brick of this class but with much lower permeability.

H-W SUPER PLASTIC

A monolith with very good workability and refractoriness equal to superduty brick.

WRITE FOR DATA

Complete product descriptions and test data are available showing the superior resistance of these refractories to aluminum alloy reaction.

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HW 61-7

me that I had not gone overboard. This outfit without a doubt is one of the very best he ever has dealt with in his long professional career. He also told me that the construction company has a rather frightening backlog and has been in business for over 50 years.

I said to begin with that these folks had every conceivable electrical and mechanical device to help them in their work—engine-drawn pumps, generators, arcweld apparatus, cutting torches, portable saws, a bulldozer, and (this item intrigued me) a high-speed motor-driven vibrator that makes concrete run down into the forms as though it were water.

Secret Is the Individual—But I'd be willing to bet a nickel to a doughnut that another gang with exactly the same equipment could fall flatter than a pancake without that intangible but real man-to-man relationship which binds this group together. I'm sure that whenever an organization is so set up and operated that it is possible for every member to distinguish himself as an individual, no matter what post he holds, and to be recognized as an individual by his associates, that organization is on solid ground.

Sometimes I wonder whether those of us in the foundry business are not inclined to be so wrapped up in the mechanics of the job we lose sight of the humanics. The accomplishments of an organization are only the sum of the individual accomplishments of each individual member in it. Consequently, man-to-man relationships become the nearest thing to a measure or essence of the health, longevity, and wealth of an organization that we're likely to find.

The chairman of the board of the Lee Hobby Foundry has hinted that so far as she can see, building bridges and making castings have little in common. I told her that I wasn't too sure. It might be a good idea if some of our foundry friends got the smell of core oil out of their nostrils and went browsing about a bit to see what's happening in other fields.

"Fred's boss took his advice for what it was worth—$50,000 worth of ruined castings"

ASTME To Sponsor Seminar On Process Planning, Reliability

A seminar on process planning and reliability will be offered by the American Society of Tool and Manufacturing Engineers on May 7-8, 1962, at the Sheraton-Cleveland Hotel, Cleveland. Registrations must be made in advance and

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Here is a revolutionary method of adding just the right amount of bond to every batch — not a constant or average amount — but the exact amount needed to bring the strength of each batch of sand to the precise desired level. No waste, no peaks and valleys in sand strengths, and no additional mixing time. Furthermore, it's completely automatic! The savings alone more than pay for a Bond Compensator.

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←Circle 622, Page 39

For More Information Circle 603, Page 39

At Wagner Castings Co....

25% savings in shipping labor with Wirebound Pallet Boxes

Bulk handling speeds weighing and shipping of castings

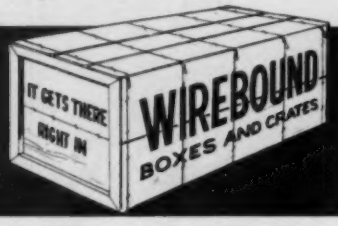
Savings of 25% to 30% have been realized by switching from bags and returnable wood pallet boxes to non-returnable Wirebounds at Wagner Castings Co., Decatur, Ill.

The time required to fill and tie bags, and the cost of returning wood pallet boxes have been eliminated. Even with their 1400-pound loads, these Wirebound pallet boxes stack safely three and four high on the shipping dock, conserving valuable space and speeding shipping operations.

Wagner's customers realize savings, too: handling is minimized—there are no bags to open, no boxes to return. Contents of the Wirebound pallet boxes are accessible for quick identification and for receiving inspection.

At Wagner, Wirebound pallet boxes loaded with malleable iron castings weigh in at about 1400 lbs.

You can realize similar savings by using Wirebound pallet boxes in your manufacturing, assembly and shipping operations. *Contact Wirebound box manufacturers for full information or write to the address below.*



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can be made up to the time of the seminar. Fees are $45 for ASTME members and $60 for nonmembers. More informatinon can be obtained from Gilbert E. Seeley, American Society of Tool and Manufacturing Engineers, 10700 Puritan Ave., Detroit 38, Mich.

Scrap Institute Issues Annual

The Institute of Scrap Iron & Steel Inc. has released its 1961 Yearbook. The book contains statistical material under 43 headings on the scrap industry's activities of last year and articles on the export trade, domestic business conditions, sources of scrap, prices, and transportation.

Its new features include tables on average annual railroad loadings of scrap, tonnage of scrap exported via American ports, three and four-city composite prices of No. 1 heavy melting steel, and new specifications for alloy scrap. Ten charts and illustrations are included in the 101-page publication.

Copies are available from the institute at 1727 H St. N.W., Washington 6, D. C.

Book Review

***Temperature Measurement in Engineering, Vol. 2*, by H. Dean Baker, E. A. Ryder, N. H. Baker, cloth bound, 510 page, 6 x 9 in., published by John Wiley & Sons Inc., 440 Park Ave. S., New York 16, N. Y. Price $13.**

Book covers design, construction, and operation of resistance thermometers and radiation detectors. Part 1 consists of two chapters each devoted to resistance thermometry and to radiation pyrometry; one a descriptive chapter and the other an analytical chapter.

Part 2 is the larger part of the book and is devoted to a selected assortment of problems which arise in the laboratory, shop, and field. Equations and charts are provided whereby the form of a design can be adjusted in numerical computations to the exact requirements of a particular measurement problem.

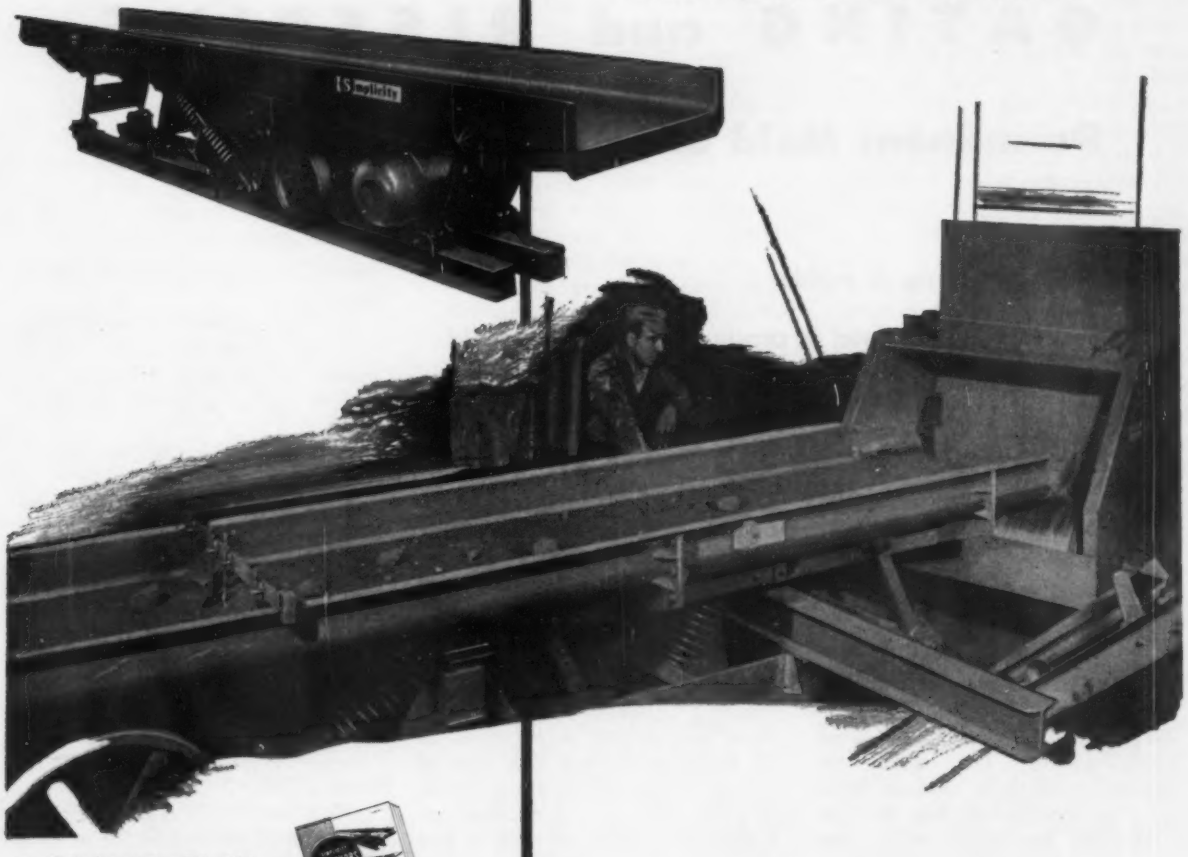
About 140 figures, including line drawings and graphs, are provided as well as several tables. All equations are stated in form suitable for direct application, and derivations have been omitted. Also, over 1000 references are listed to provide sources of additional information.

An Eastern Foundry Conveys and Cools 120 Tons per Hour of Sand with Simplicity "VS" Conveyor

The Simplicity model "VS" conveyor shown moves hot sand from two shakeouts, up a three degree incline, to an elevator at an average rate of 80 tons, with a peak load of one hundred twenty tons per hour. As the sand moves along the conveyor deck, water is added and plows turn the sand thus reducing the sand temperature one hundred degrees. The sand is discharged from the conveyor into the elevator boot over a permanent magnet which removes all of the metal particles.

Simplicity conveyors have proved efficient for transferring materials such as sand and castings, from one point to another. Feed points can be positioned along the length of the conveyor, and materials transferred to a common discharge point.

"VS" conveyors are available in widths from 12" to 36" and in lengths from 10' to 60' with one drive assembly. At customer request, these conveyors can be equipped with liners, covers, or can be built in two surface units.



Write for catalog C-1 which describes the various models of Simplicity Conveyors.

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FOR CANADA: Simplicity Materials Handling Limited, Guelph, Ontario.
FOR EXPORT: Brown & Sites, 50 Church Street, New York 7, N. Y.

224

By HOWARD U. McCLELLAND
Chief Engineer, Foundry Div.
Eaton Mfg. Co.
Vassar, Mich.

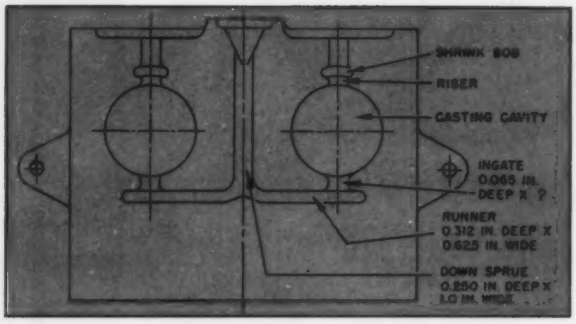


Fig. 1—This is a typical layout of a flat gating system for a two-cavity mold

GATING and RISERING

Permanent Mold Gray Iron Castings

The three major types of mold cavity feeding systems used in producing permanent mold gray iron castings are described in detail

● THE GATING of gray iron castings produced in permanent, metal molds generally follows the principles discussed for other metals with the limitations of gate location at the parting line.

Although gray iron does not dross readily, it has been shown that non-pressurized gating systems that minimize turbulence, air aspiration and metal damage are desirable to avoid gating defects.[1] The risering requirements of these castings, however, are considerably less than requirements for other metals and even the same metal in other types of molds.

The permanent molding process limits both the complexity of the casting and the design of the gating and risering systems. The gates and risers must be located at the parting line. Single, straight parting lines are desirable from a mold cost standpoint, although this can be varied when absolutely necessary. In any event the necessity of stripping the casting and gates and risers from the metal mold restricts the designs that can be employed. These conditions are similar to that recently described for aluminum castings produced in permanent molds.[2]

The process employed for the permanent molding of gray iron castings has been described in the literature.[3,4] Essentially the same machine and process is employed in all foundries making this type of casting. These castings are produced in a turntable type of machine operating on a rotational cycle of two and one-half to six minutes or even longer, depending on the solidification time of the castings produced. Twelve permanent metal molds are installed in each machine.

The molds are cast to close tolerances from the same type of gray iron employed for the castings and are machined to final dimensions. The mold wall thickness varies from 0.50 to 1.25 in.

The following castings production cycle is employed on the turntable machines:

1. Mold is blown out for cleaning.
2. Surface of the mold face is coated with a layer of carbon deposited by a reducing acetylene flame.
3. Cores, if required, are set.
4. Casting is poured.
5. Casting is ejected from the mold.

All operations are performed while the machine is in motion.

Various size molds are employed with the largest having either a 16 x 20 or 18 x 18-in. face area, depending on the machine. Casting weights vary from a few ounces to 25 lb or even larger in special cases. The section sizes of the castings vary from 0.190 to 2 in.

Placement of the maximum number of mold cavities in the mold is an important economic consideration. Multiple cavity molds are employed when feasible, although some of the larger castings are made one per mold. All gating systems are of the vertical type. Obviously, the type of gating system is influenced by the number and type of castings.

A high carbon equivalent iron, slightly hypereutectic in composition is generally employed for permanent molded gray iron castings.

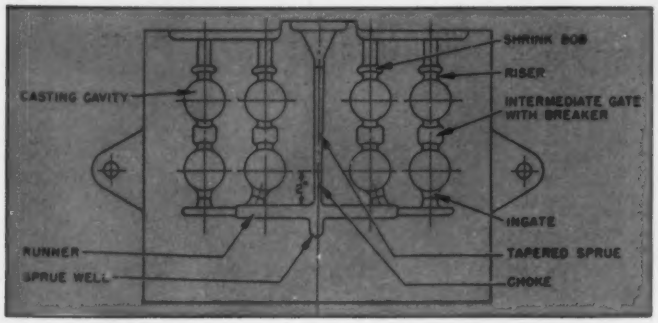


Fig. 2—Round gating system for this multiple cavity mold uses fluid flow laws

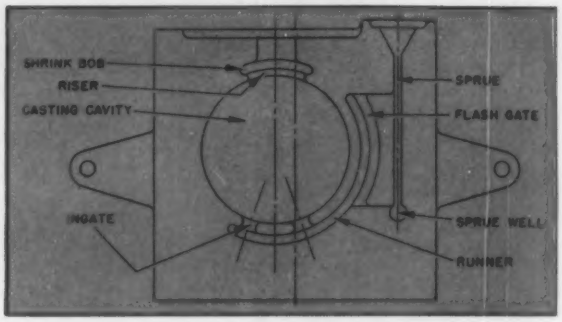


Fig. 3—Flash gating is relatively new. It's successful for circular castings

A typical composition contains the following percentages of constituents: 3.55 C, 2.55 Si, 0.80 Mn, 0.08 S, and 0.20 P. This type of iron has excellent fluidity and does not exhibit any solidification contraction. All castings are annealed at 1650° F to remove any chilled sections caused by the rapid solidification rate. This fast solidification rate against the metal mold improves properties somewhat compared to conventional sand castings of equivalent section size and composition.

Gating—The pouring, or mold filling time, and the velocity of the metal flowing through the runners and ingates are considered the important functions of the gating system. Since the metal is poured into metal molds with zero permeability, sufficient time must be allowed to displace the air through the risers or vents supplied for that purpose. For this reason the molds are filled as slowly as possible without producing short pours or lack of detail.

Other factors considered are fluidity (usually excellent with the hypereutectic iron commonly used) and the time available for pouring the molds and refilling the ladles in a continuous pouring process. The velocity of the metal in the runner is important since it has been proved that a velocity of 12 ips is the maximum permissible to allow the metal to clean itself by permitting slag, or other inclusions, to come to the top surface in the runner. The velocity is reduced by increasing the area of the cross-section of the runner and has the undesirable effect of reducing casting yield. However, it is felt that the increase in casting quality more than offsets this slight decrease in yield.

As in all systems, compromises have to be made at times due to space and time limitations, but every effort is made to maintain the minimum velocity. Low velocities of metal in the ingates entering the mold are necessary to reduce the erosion of projections in the mold, or of any sand cores employed. If the system is designed properly, with the preceding considerations kept in mind, pouring temperatures controlled, and down sprues kept full during pouring, favorable results can be obtained regularly.

Generally speaking, three types of systems have been used during the forty-year history of the process. To identify the differences between these systems, they may be designated as flat, round, and flash. Each will be discussed separately.

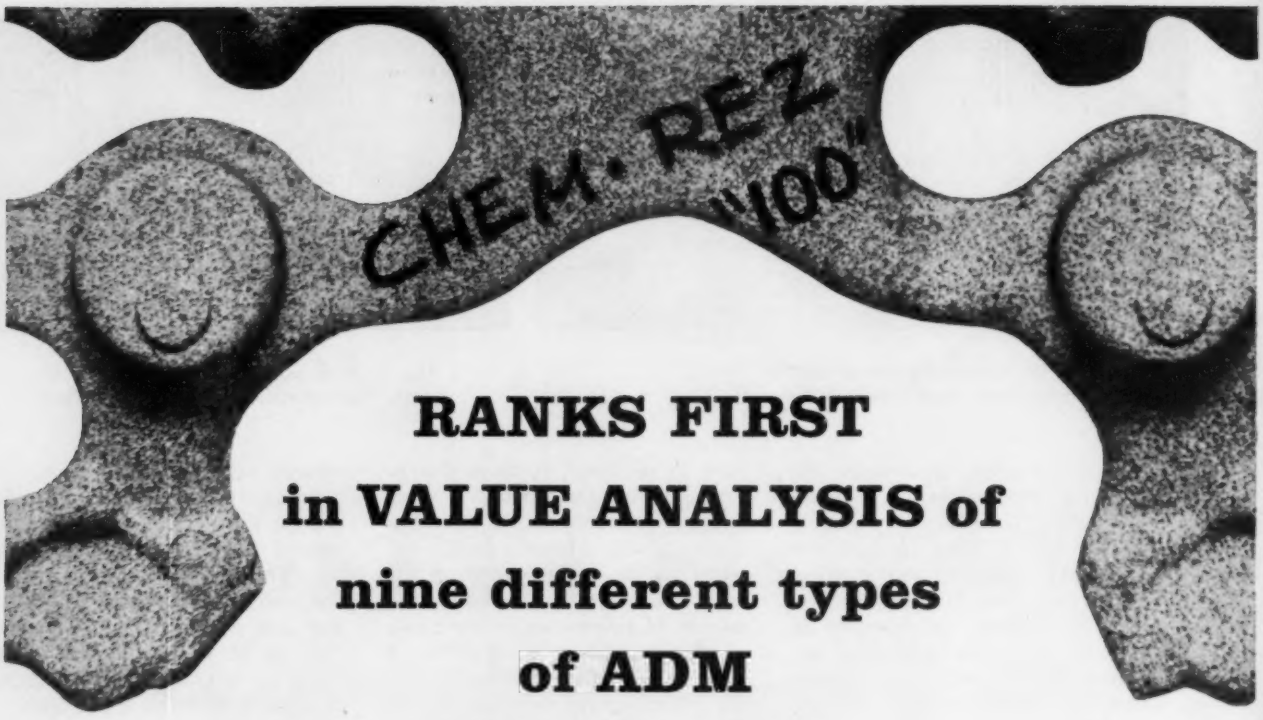
Flat Gating—Probably the outstanding feature of this system is its simplicity. The system shown in Fig. 1 undoubtedly was over-simplified, since the only element that was varied was the width and number of ingates, regardless of number of cavities, weight of metal poured or the pouring cycle. All ingates were made 0.065 in. deep, down sprues 0.250 in. deep by 1 in. wide and runners 0.312 in. deep by 0.625 in. wide. The sprue basin was placed in the outer half mold only and, in combination with the flat, rectangular sprue, eliminated vortexing and resulting aspiration.

Pouring times were controlled by varying the width of ingates and were determined by trial and error. This was done because the system is pressurized, choked at the ingates. This method was time consuming but adequate until the mold had to be repaired by grinding as the ingates cracked and eroded from the concentration of heat and high velocity of the metal stream.

Enlarging the choke area decreased the pouring times and increased velocities in the entire system. This resulted in gating defects and lower casting quality due to gas and slag inclusions. It was found that, in most cases, 0.065 in. to 0.075 in. was the maximum depth of ingate permissible if a serious incidence of gating defects was to be avoided.

The difficulties caused by gradually increasing ingate depths as this area was repaired, coupled with excessive ingate velocities, led to an extensive search for a system that would incorporate the laws of fluid flow and eliminate the known deficiencies of the flat gating system. This new system has caused the abandonment of flat gating except in those proven cases where over a long period of time the casting scrap and mold life experience have been satisfactory.

Round Gating—This method, Fig. 2, is not an original development for permanent molded gray iron castings but an adaptation of the work of many other investigators whose interest was in gating systems for sand molds. Since sand molds frequently are horizontally parted, the problem was to adapt the principles to vertical gating. These principles were set forth very clearly in the articles on gating[5] and on shell molding[6]. This type of gating system is nonpressurized and employs a tapered, big-end-up sprue choked at the bottom with enlarged runners and ingates to reduce the molten iron velocity in these portions. It has been possible to establish procedures and formulas that have eliminated the art from the process and the need for



RANKS FIRST in VALUE ANALYSIS of nine different types of ADM core binder!

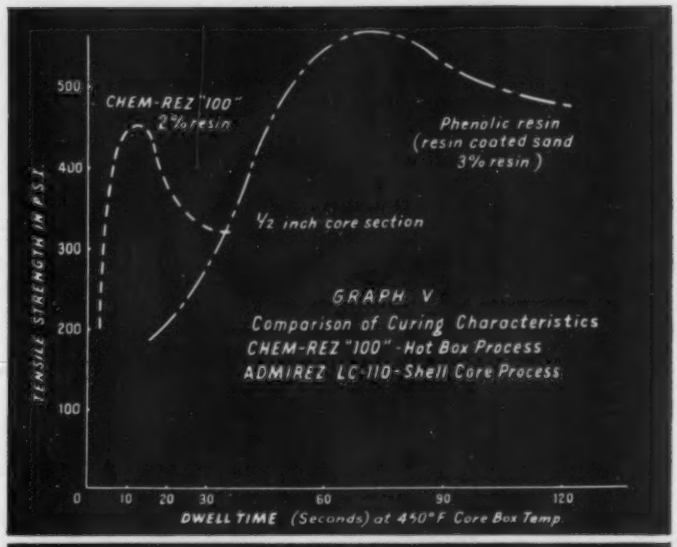
CORE MAKING METHOD									
BINDER	CHEM-REZ "100"	CHEM-REZ "100" with LINOIL	CHEM-REZ A-200	LIN-O-SET	LINOIL	ADCOSIL	ADMIREZ PHENOLIC	ADMIREZ PHENOLIC	ADMIREZ UREA
PROCESS	HOT BOX	OVEN BAKE	NO-BAKE	AIR SET	OVEN BAKE	CO_2	SHELL	OVEN BAKE	OVEN BAKE
CURING PRINCIPLE	Chemical & Heat	Chemical & Heat	Chemical	Catalytic, Oxidation & Heat	Heat	Chemical	Heat	Heat	Heat
RANK in relation to:									
ACCURACY (core dimensions)	1	2	1	1	2	1	1	2	2
SPEED OF PRODUCTION (output per worker)	1	3	5	6	4	2	2	4	3
ECONOMY (Sand Mixture)	3	2	7	6	1	4	7	5	2
CONVENIENCE (Handling, Tooling or Precautions)	1	5	3	4	5	2	2	5	5
SIMPLICITY (Core quality Control)	2	1	5	6	1	4	3	1	1
VERSATILITY (Range of metals & core type)	2	2	4	4	1	5	3	3	4

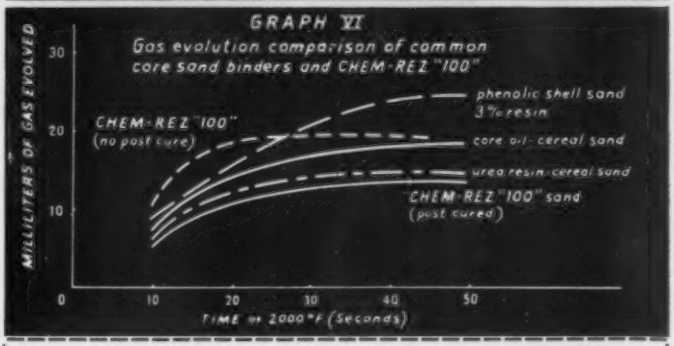
NOTE: Rankings given are in terms of "order of preference." No attempt is made in this comparison table to rate the various processes in terms of their relative value in each functional category.

A comprehensive technical bulletin on CHEM-REZ "100" has been published by ADM to keep foundrymen up to date on the latest performance and application data. A copy is yours for the asking.

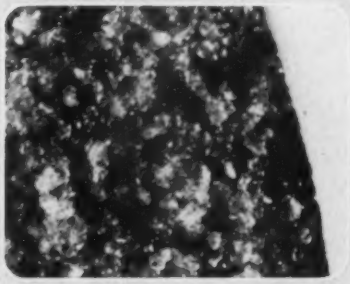
Graphs V and VI (right), taken from this 16-page bulletin, are typical of its contents. Other charts and tables cover: sand mixtures and cycles; core box temperatures; effect of resin and catalyst content; comparison of various types of catalysts; effect of core section thickness on tensile strength build-up; and comparative high temperature properties of CHEM-REZ and oil and cereal cores.

Also discussed is the application of CHEM-REZ "100" to various curing techniques such as: hot box; combined core oil and resin; oven baking — conventional, dielectric, infra-red, or re-dry.





VELVAWASH CR-100... the wash that's MATCHED to CHEM-REZ "100" cores



Twenty-power magnification shows CHEM-REZ "100" hot box core coated with VELVAWASH CR-100. This wash clings tightly without penetrating so deeply that strength of the surface is deteriorated.

ARCHER-DANIELS-MIDLAND COMPANY
Federal Foundry Supply Division
2191 West 110th Street, Cleveland 2, Ohio

☐ Please send Technical Bulletin on CHEM-REZ "100"

☐ Also information on VELVAWASH CR-100

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experience to produce gating systems that work. In the six years since its inception, there have been no quality difficulties directly attributable to round gating.

The elements of the system to be considered may be stated as: Pouring time, cross-sectional area of choke at bottom of sprue, cross-sectional area at top of tapered sprue, the sprue well, cross-sectional area of runner, and ingate areas. The calculations for each follow:

Pouring Time—The machine cycle time that will be used for any particular mold can be determined. This cycle time is controlled by the weight, section size, geometry of the casting and machine considerations. To find the pouring time, the cycle time (time of a complete revolution of the machine) in seconds is divided by 12 (the number of molds on the rotary machine) to find the time for each mold to pass the pouring station.

This quotient then is multiplied by 0.4 for cycles of 2.5 minutes to 4.0 minutes and by 0.5 for slower cycles. This procedure normally gives an adequately slow pouring time and allows time for filling the pouring ladle without stopping the machine.

Area of Choke—With a tapered sprue, small-end-down, the flow rate through the small end is proportional to the square root of the height of the metal in the sprue and pouring basin above the choke area at the small end of the sprue. Before the area of the choke can be computed, the effective sprue height (average sprue height) must be found. In bottom gating the flow rate is reduced effectively by the back pressure exerted by the height of the metal in the mold cavity as the casting cavity is filling.

Therefore, the effective sprue height (ESH) is found from the formula ESH = H − C/2 where H is the distance from the top level of molten iron in the pouring basin to the sprue choke in inches and C is the casting height in inches, as shown in Fig. 2. When the pouring time is established and the ESH is found, the area of the choke is computed from the following formula:

$$\text{Area of choke} = \frac{W}{t} \times \frac{K}{\sqrt{ESH}}$$

where: W = casting weight in pounds
t = pouring time in seconds
ESH = effective sprue height
K = a constant which compensates for friction loss, acceleration of gravity, metal density, and individual foundry practice and has been found to be 0.20 or slightly less, depending on frictional losses

Top of Sprue Area—This area can be computed mathematically based on the square roots of the relative heights of metal over the sprue choke and over the top of the sprue in the pouring basin. In most cases an area approximately 30 per cent larger than the choke area is suitable.

Sprue Well—The well is ¾ in. in diam and extends 1 in. below the runner. It eliminates erosion of the bottom of the sprue and reduces turbulence where the direction of metal flow changes abruptly.

Area of Runner—It is desirable that a runner length of 6 in. or more and a velocity of no more than 12 in. per second be maintained. However, it is rarely possible to achieve this goal due to the size of the mold and the necessity of using as much of the mold face area as possible for casting cavities. To compensate for this lack of runner length and to maintain a relatively slow runner velocity, it is necessary to increase the diameter of the runner on the shorter runners. The cross-sectional area of the runner is found from the following formula:

$$\text{Area of runner} = \frac{W}{t \times D \times V \times R}$$

where: W = casting weight in pounds
t = pouring time in seconds
D = density of liquid iron, 0.22
V = runner velocity in inches per second
R = number of runner branches

For the purpose of simplification, it has been found that two times the runner length can be substituted for runner velocity. Unless the mold is to be run on a very slow cycle, a ¾-in.-diam runner is a maximum even though the calculations indicate a larger diameter. In multiple cavity molds, the runners are reduced by the ingate area as each ingate is passed to provide equal flow through each ingate.

Ingate Area—The individual ingate area is found by multiplying the choke area by a factor of three or four and dividing this product by the number of ingates required. This effectively provides an area ratio of choke : runner : ingate of 1:3:3 or 1:4:4. As shown in Fig. 2, ingates nearest the sprue often are inclined at a reverse angle of approximately 15°. Although this may increase turbulence slightly, it is

Fig. 4—View shows a worker removing a casting from a permanent mold mounted on a turntable

IMC A REPORT TO FOUNDRIES FROM TOM BARLOW

these are swell shrinks

One of the recurrent problems in any foundry is the "here-today, gone-tomorrow" shrink. This gremlin has some real gone habits. Ever get a pattern that another foundry has gated — and wonder how they ever avoided the shrinks you get with their gate? Ever have a casting that shows "shrink" defects in the afternoon but not in the morning? Ever stop a shrink by adding more risers, only to find that next week the shrink comes back and won't go away until you take the riser off? Such is a gremlin shrink.

To avoid confusion, we hasten to point out that there *is a true shrink.* This defect responds to normal feeding practice or changes in metallurgy. But the "shrink" we are talking about is different. Some call it an "apparent shrink." Some call it a "shrink-blow" — and with good reason. Since I like puns, I'll call it a swell shrink because it is related to minor swells or mold-wall movement. It's also swell in the sense that Plasti-Bond and high clay is the best cure — and we sell both. Sand to cure a shrink? Yes, indeed!

Make a thin plate 12" square with a small boss on it. *If the thickness of that plate increases by 0.001", it will put a shrink in the boss ½" in diameter.* This is mathematics, not metallurgy — it applies to steel, malleable, non-ferrous. It might be likened to a milk bottle which is gradually getting bigger, so you must keep on pouring in liquid to keep it full. Plasti-Bond and/or high clay and hard ramming will improve your yield by reducing the need for feed metal to fill a *growing* mold. In steel, malleable and non-ferrous, the mold-wall movement only helps to promote true shrink and create the need for additional risers. That is bad enough!

In graphitic metal, including all forms of gray iron, the gremlin shrink really becomes a deadly enemy. This is his breeding ground. Why? These metals do have initial shrinkage *but the shrinkage is followed by expansion.* The expansion does two things. First, it increases the mold-wall movement because it exerts pressure greater than just the ferro-static pressure of the sprue height. Secondly, and most important, it tries to counteract all efforts to feed it with normal practice. During the expansion, the metal is *pushing in all directions.* It pushes against the mold—and also *it pushes against* the feed metal — and may push it right back out the riser! No wonder it is erratic — mold-wall movement, in most foundries, *is a variable.*

We said Plasti-Bond and more clay help to get this gremlin out of our hair. Plasti-Bond not only helps to ram a dense mold by increasing flowability; *in addition, it stops the scabs and buckles usually* accompanying such hard rammed molds. However, for the sake of the record, we must mention that many other factors influence this problem — and increase or decrease the need for good molds. 1). Pouring temperature is involved because it changes the degree to which the mold heats up — it moves faster hot than cold (unlike me). 2). Nodular is worse than gray iron because it has a longer solidification range. 3). Inoculated and alloyed high strength irons are worse than soft irons because the cell structure is smaller — and the expansion pressure is greater.

Don't accept mold-wall movement with a shrug of resignation. Do something about it with Plasti-Bond!

FS-5-2

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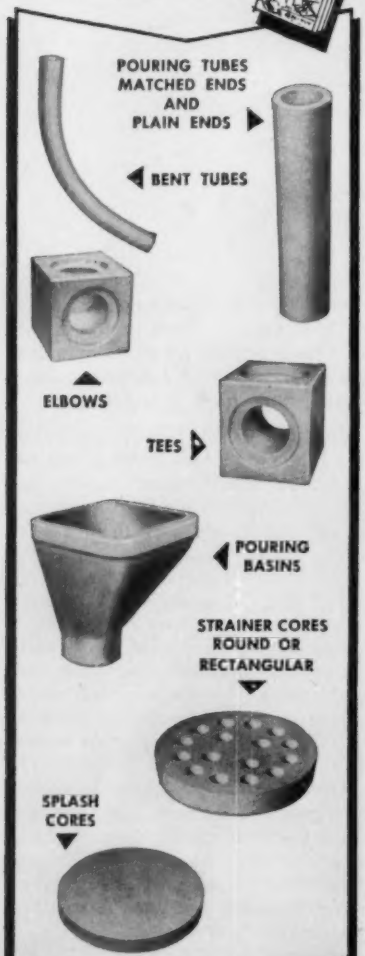
• The *Thinwal* construction, providing as much as *35% lighter weight* will not spall nor erode in use even at temperatures up to 3250°F. They eliminate slag inclusions, stop rejects, reduce cleaning room time.

Standards and specifications bulletin available on request. Units for special applications quoted.



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For More Information Circle 608, Page 39

felt that the additional runner length is desirable from the aspect of clean-up in the runner.

Relatively small radiuses also can be used at the junction of the runner and ingates without serious problems. Investigation over a considerable length of time, as well as moving pictures taken of transparent molds, indicate that no serious detrimental effects are experienced from these sharp radiuses.

Flash Gating—This method of gating, Fig. 3, has been employed for a short time and has proved very successful in producing circular-shaped castings such as sheaves. This gating procedure is particularly effective for the heavier castings produced by the permanent mold process. To date, no specific formulas have been developed for computing sizes of the gating components. By grouping the castings according to size, weight, or section thickness, a small number of procedures each with its own set of dimensions for the various elements of the gating system have been developed.

Further work is proceeding to obtain detailed formulas to establish the sizes of the gating systems components. Referring to Fig. 3, the sprue diameter varies from $\frac{3}{8}$ in. to $\frac{1}{2}$ in., the flash gate is 0.025 in. to 0.035 in. in depth, the runner diameter is from $\frac{3}{8}$ in. to $\frac{1}{2}$ in., and the total ingate cross-sectional area is always at least two times the cross-sectional area of the flash gate (total length times depth).

This results in a system that is choked primarily at the flash gate. As in all cases where the engineering principles involved are not definitely established, a certain amount of trial and error is necessary. The system can be used for multiple cavity molds but has been most successful when used for single, circular cavities. It has a demonstrated capability of eliminating slag and other impurities from the cavity.

Risering—The risering requirements to obtain soundness in permanent molded gray iron castings are minor because of the composition of the iron poured and the nature of the mold.

The iron is either of eutectic or slightly hypereutectic composition and does not undergo any solidification contraction. Sufficient graphite is formed upon solidification to more than compensate for the contraction of the eutectic austenite.[7]

The metal mold walls are rigid and no mold cavity expansion occurs.

Since solidification contraction and, particularly, mold cavity enlargement are the primary causes of shrinkage in gray iron castings, only small risers are required in permanent molds. It is not necessary that risers remain liquid until the casting solidifies.

Risers also serve the following secondary purposes:

1. To compensate for liquid contraction in cooling from the pouring to solidification temperature.
2. Venting the mold cavity.
3. To maintain mold temperature in portions of the mold.
4. Breakers to reduce the amount of grinding in cleaning the casting before shipping.
5. Showing when mold cavity is filled.

No definite procedure has been developed to establish riser dimensions in permanent molded gray iron castings. Their dimensions as shown above are not set primarily by feeding considerations but depend upon other casting factors. As such, they usually are established by experience or adjusted as required. In general, the risers are larger in cross section than the ingates.

Summary—Good gating procedure and casting design are primary requirements for good casting quality and satisfactory operation of a permanent mold gray iron foundry. Acceptable systems can be designed that are based on theory and practical to use.

Further development of improved gating practice is both feasible and desirable. The risering requirements of permanent molded gray iron castings are minor.

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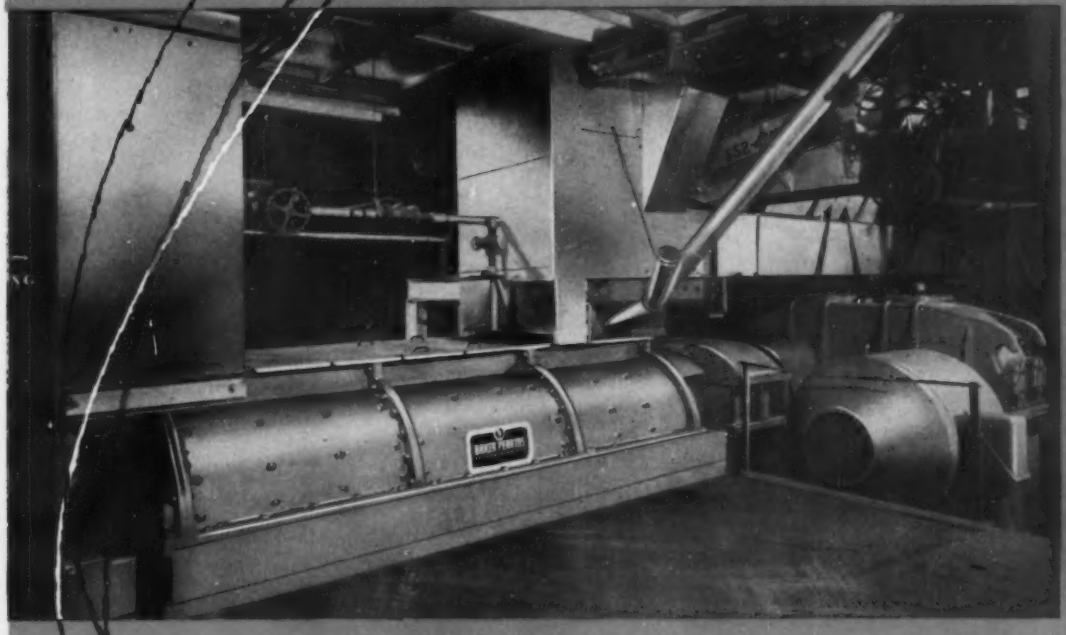

The new Baker Perkins Size 8 Muller, now in successful operation in one of the midwest's automotive foundries, has 300% more hourly capacity than any available batch type muller and 100% more capacity than the next size B-P continuous unit. As with all B-P Continuous Mullers, cleaner, smoother castings are obtained with fewer rejects because molding sands are thoroughly mixed and tempered. The special Sigma-type agitators assure that each grain of sand is coated with the correct proportion of bond.

Baker Perkins builds Continuous Mullers in capacities from 30 to 300 tons per hour. Because of their rigid, rugged construction, B-P Continuous Mullers give many years of service. Installations in many of America's largest foundries have proven the efficiency of Baker Perkins Continuous Mullers under the most exacting conditions.

For further information about B-P Continuous Foundry Sand Mullers and B-P Unidor mixers for core and special process sand mixing, send for catalog No. F-156.

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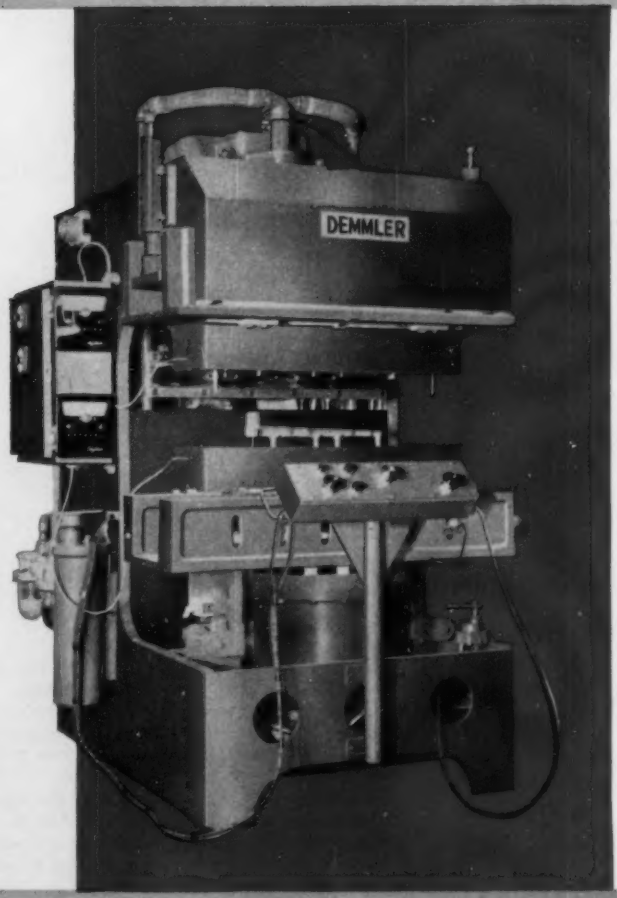
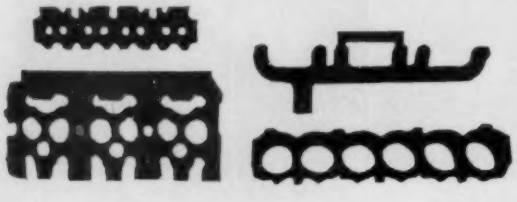
DEMMLER advance-engineering has produced this high-production, low-maintenance edge-blow core blowing machine with fully-automatic cycle. Versatile, it blows cores from pin-type to 48" long. A new ejector feature lifts cores from core box easily without breakage. No rapping or vibration required. Its large capacity blow valve and air-receiver permits core-blowing pressures to 100 psi. Available in three sizes to fill a wide range of applications. Wire or write for additional details and quotation.



Typical cores produced by DEMMLER Edge-Blow machine:



DEMMLER Manufacturing Company
Kewanee, Illinois

For More Information Circle 610, Page 39

INDUSTRY BRIEFS

Moline Malleable Iron Co., St. Charles, Ill., manufacturer of malleable iron castings and chain, is building a 5000-sq-ft addition to its plant at a cost of between $50,000 and $60,000. To be completed in October, the space will be used for a modern washroom and additional office facilities.

Process Equipment Engineers, Plainfield, N. J., has been appointed representative for Lehigh Fan & Blower Div., Fuller Co., Catasauqua, Pa., in New Jersey, New York, and western Connecticut. Offices will be located at 638 Valley Rd., Watchung, N. J., and will be headed by Theodore J. Zeller.

Bartlett-Snow-Pacific Inc. has moved its New York office to the American Metal Climax Bldg., 1270 Avenue of the Americas.

Elwell-Parker Electric Co., Cleveland, has appointed King & East Machinery Corp., 2050 Bryant St., Denver, and Heubel Material Handling Equipment Co., 4125 Pennsylvania Ave., Kansas City, Mo., to be sales representatives for its electric industrial trucks.

Dow Chemical Co., Midland, Mich., has concluded a 15-year technical information exchange agreement with Kobe Steel Works Ltd., Tokyo, Japan. The two companies will trade newly developed information on magnesium sand casting, permanent mold casting, and diecasting, plus rolling, extruding, fabricating, and surface finishing that metal.

B-Mold Div., Buckeye Brass & Mfg. Co., Mansfield, Ohio, suffered an explosion and fire which destroyed the plant. Total damage was estimated at $200,000.

Bay State Abrasive Products Co., Westboro, Mass., is setting up a manufacturing subsidiary in Steinsel, Luxembourg. Construction for the new plant will begin immediately with production of grinding wheels planned to start next spring. Its entire production will be sold in the European market.

Hamilton Foundry Inc., Hamilton, Ohio, will receive an award on Oct. 18 from the National Safety Council for placing first in its classification in the NSC safety contest which ended July 1. Hamilton Foundry's last lost-time injury was on Dec. 9, 1959.

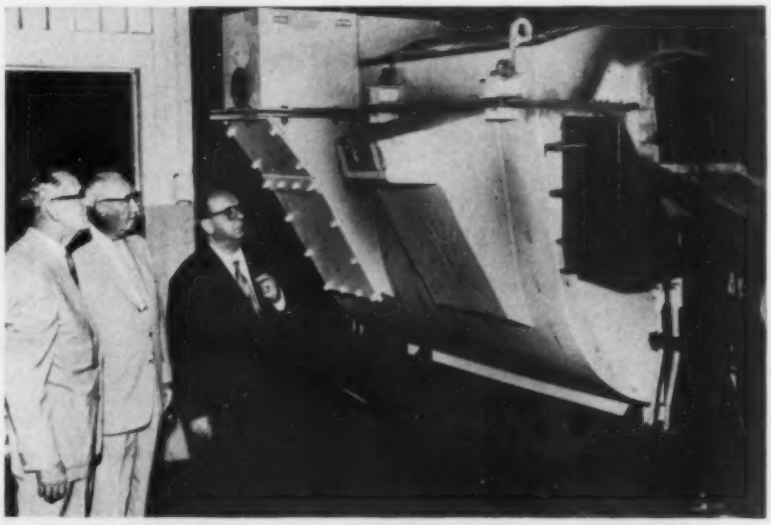
American Colloid Co., Skokie, Ill., is constructing a plant addition of more than 5000 sq ft to expand laboratory facilities and provide more office space. Completion is scheduled for early fall.

Southeastern Loom and Machine Works, Greenwood, S. C., has been purchased by the Roberts Co., Sanford, N. C. The foundry and machine plant will become the Greenwood Div. of Roberts, and plans call for an expansion in employment from 175 to 300 workers.

Precision Castings Corp., an affiliate of Detroit Industrial Products Corp., has moved into a 10,000-sq ft plant in Oak Park, Mich. Over $100,000 has been invested in new equipment, including new induction furnaces with melting capacity up to 3000 lb.

Ohio Fire Brick Co., Oak Hill, Ohio, has started construction of a new plant, adjacent to the present Cambria Clay Co., west of Jackson, Ohio. The new plant will manufacture basic refractories.

Paga Molds Inc. of Augusta, Ga., and Greenville, Pa., has signed licensing arrangements with Compagnie de Pont-A-Mousson of France for a new ingot mold manufacturing process using ductile iron. The company will handle licensing



FIRST FURNACE: The first American installation of a new line of low-frequency induction furnaces has been made at the Sibley Machine & Foundry Corp., South Bend, Ind. Inspecting it, left to right, are Elton E. Staples, president, Hevi-Duty Electric Co., Watertown, Wis., a division of Basic Products Corp.; B. J. Voll, chairman, Sibley Machine & Foundry; and Aldo Tagliaferri, director general, Forni Elettrici A. Tagliaferri, Milan, Italy. Forni Elettrici developed the line of 50-60 cycle furnaces, and Hevi-Duty will manufacture them in the United States. The 4-ton forehearth which has been installed at Sibley will be used to refine iron melted in the cupola

43 Stories of Cast

Cast aluminum spandrel is locked in place on the 41st floor.

Note the alternate window-spandrel design and the elimination of horizontal bars creating the high-rise appearance. One of the unlimited possibilities of cast aluminum panel construction.

Aluminum Spandrels

N.Y. Skyscraper Creates New Markets for Cast Aluminum

It took new foundry skills and engineering bravado—but 750,000 pounds of aluminum and 6,500 castings later New York has a new skyscraper, a bank has new quarters, and cast aluminum has earned a new reputation!

The First National City Bank Building at 53rd and Park Ave., New York, pioneered new methods of building design and construction. It proved the time-saving, money-saving, versatile features of cast aluminum spandrel construction.

Orberdorfer Foundries, Inc., Syracuse, N.Y., produced the castings. Seven basic patterns, with minor variations, met all requirements. Spandrels were cast in jolt-rollover draw equipment from Reynolds Alloy 43. Sizes ranged from 4 ft. x 4 ft. to 4½ ft. x 9 ft.

After sand blasting and heat treatment they were anodized to a permanent blue-gray, protected with temporary plastic, and shipped to the construction site as needed.

On the job, spandrels were easy to handle, ranging from 75 to 200 pounds. They were delivered, a floor at a time, and locked into place between the mullions. Flexible design and low construction costs were made possible by casting window mounts, flanges, and bosses as an integral part of the spandrel.

Gleaming, weatherproof Reynolds Aluminum will never need refinishing. It is immune to fungus, mildew, and termites. It keeps the building cooler in summer, warmer in winter.

Reynolds offers many alloys for permanent mold, sand mold, and die casting, plus marketing and research information to help you develop new markets for aluminum castings. Contact your Reynolds Ingot Distributor, your nearest Reynolds Branch Office, or write *Reynolds Metals Company, P. O. Box 2346-FK, Richmond 18, Va.*

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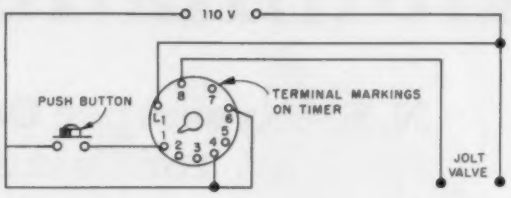
Watch Reynolds exciting TV programs on NBC: The Dick Powell Reynolds Aluminum Show every other Tuesday; Say When, weekdays; All Star Golf—in living color—every Saturday.

For More Information Circle 611, Page 39

HOW TO DO IT

Molding Jolt Control System Uses Simple Timing Device

By **HOWARD T. BAILEY**
Electrical Engineer
Universal Foundry Co.
Oshkosh, Wis.



TO MAINTAIN the proper and consistent green hardness of molds produced on jolt machines, the proper number of jolts must be used on all molds in the production run. Too few jolts often result in oversized castings, and too many jolts accomplish nothing other than unnecessary wear on the molding machine.

One way to keep tab on the number of jolts is to use a jolt timer on each machine. Timers are relatively simple, inexpensive, and require little maintenance. We have equipped a number of molding machines with jolt control systems.

The parts required are a 60-second timer, a mushroomhead push button momentary contact switch, and a ½-in. normally-closed solenoid valve as shown in the diagram.

The timer is set to the required number of jolts determined by the cut and try method. The button is pushed to energize the timer motor and the solenoid jolt valve. At the end of the preselected time interval, the timer and jolt valve are de-energized, and the timer automatically resets to zero, ready for another operation.

It is well to pipe the jolt solenoid valve so that it by-passes the knee valve on the molding machine. In this way the machine can be used manually or with the jolt timer control.

Have any ideas of your own? FOUNDRY will pay a minimum of $15 for each "How To Do It" item submitted and published

arrangements in this country and will provide engineering and design service in addition to installing the new process.

Aluminum Association reports production of 157,544 short tons of primary aluminum in May 1961, as compared with 175,863 in May 1960, and 180,997, the all-time record month in July 1959.

Industrial & Foundry Supply Co., Oakland, Calif., has moved to a new warehouse and office building at 24th & Poplar, Oakland. Mailing address, P. O. Box 4053, remains the same.

Wellman Bronze & Aluminum Co., Bay City, Mich., has marked its completion of 2 million consecutive manhours of work without lost-time injury for its more than 500 employees. The last such injury occurred July 20, 1958.

G. E. Smith Inc., Pittsburgh, has signed a license agreement with Vereingte Chemische Fabriken — Kreidl, Reuter & Co., for the production of G. E. Smith products for sale in Austria and other European countries. Smith established its first such license earlier this year in Dusseldorf, Germany.

Eastern Welding Equipment Co. Inc., Westbury, N. Y., has been appointed welding products distributor in Long Island and New York City for Ampco Metal Inc., Milwaukee.

Gifford-Wood Co., Hudson, N. Y., has appointed W. S. Mott Co., 201 N. Third St., Minneapolis, to be general sales agent for its conveyor division in North and South Dakota, Minnesota, northern Wisconsin, and eastern Iowa.

Misco Precision Casting Co., a division of Howe Sound Co., Whitehall, Mich., has made a licensing agreement with Deutsche Edelstahlwerke A. G. of Germany to use a new vapor diffusion process for coating castings to increase abrasion resistance, corrosion and high temperature oxidation resistance, and thermal fatigue properties of many metals and alloys.

American Railway Car Institute reports 3142 new freight cars were delivered in June, compared with 3360 in May and with 6042 in June, 1960. Orders for new freight cars amounted to 1214, against 3666 in May. Backlog of cars on order and undelivered as of July 1 was 8489.

Crane Co., New York, has merged J. Cocard Lille and C.I.C.R.A., both of Paris, France, to form Cie. Crane in Paris. Control of the French firms, both of which manufacture valves, was acquired by Crane last year.

Gibbs Foundry Co., Greensboro, N. C., suffered an estimated $25,000 damage from fire in one wing of its plant.

Homer Foundry Corp., Coldwater, Mich., destroyed by fire on June 28, will not reopen.

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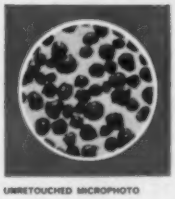
TERMCO—the new, hard, round-grain carbon sand—is solid, inert carbon. Its thermal stability is far superior to the best silica sand. And it needs no iron oxide and cellulosic cushioning agents. With TERMCO, there's no veining, scabbing, penetration or burn-on. Castings just naturally come cleaner, more accurate, precise. That's why TERMCO cores and molds are the most dependable — especially for the most difficult casting jobs. And TERMCO replaces zircon, olivine, and other non-silica sands at lower net cost. Requires no special methods or equipment. Why not get all the facts on TERMCO—now! Send today for detailed information.



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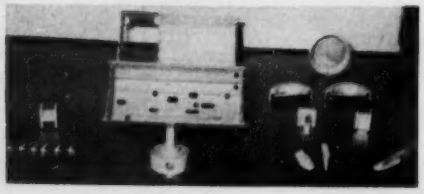


Hard-to-make diecastings shown here are, left to right and front to back, 6-cavity cams, wave guide, cylinder head, missile cans, static precipitator, wave guide, air sampler

Micrometer testing 2½-in. protrusion on cylinder head. This was cast without draft to save machining

One diecasting, for an air pollution sampler, has a thin center section with an area of 16 sq in.

Company Successful in Making

DIFFICULT DIECASTINGS

Closeup shows fit of interlocking diecastings. Hundreds of these are joined to form room dividers

By HOWARD E. JACKSON
Redwood City, Calif.

● INSTEAD of saying "It can't be done" when a difficult job comes in, personnel at Western Die Casting Co., Emeryville, Calif., say, "Let's see how we can do it." As a result, this diecasting company has been producing many jobs which otherwise might have been considered almost impossible.

For instance, one job requires minimum wall sections of 0.010 in. Another job—a large magnesium diecasting—is made without draft. And still another job requires a dimensional tolerance across the parting line of plus or minus 0.0005 in.

Wave Guide—One example is a wave guide made of 218 aluminum alloy, one which is difficult to diecast at best. Wall thickness on this part varied from a minimum of 0.010 in. to ⅜ in., and specified tolerances across the parting line were plus or minus 0.001 in. In addition, the thin section had to be sound and accurate to receive pole pieces. Although extra care was required to cast this wave guide to these specifications, the more costly machining operations that otherwise would have been necessary were avoided.

Another diecasting of 218 alloy had a center area of 16 sq in. that was only 0.045 in. thick. This center section was surrounded by a ring with a nominal wall thickness of 0.125 in. The choice of alloy (for good corrosion resistance with high strength) plus the casting configuration made the part difficult to produce, but the center section had to be free of porosity and surface defects because the customer had to drill 400 holes 0.010 in. in diameter in this area. The first set of castings was so successful that the company made additional tooling for similar ones.

Precipitators—Careful gating and venting techniques, also accurate metal temperature and die temperature control, were required to make static discharge precipitators for jet aircraft. These parts, of complex shape, had to have sufficient accuracy so that mating parts would fit together properly.

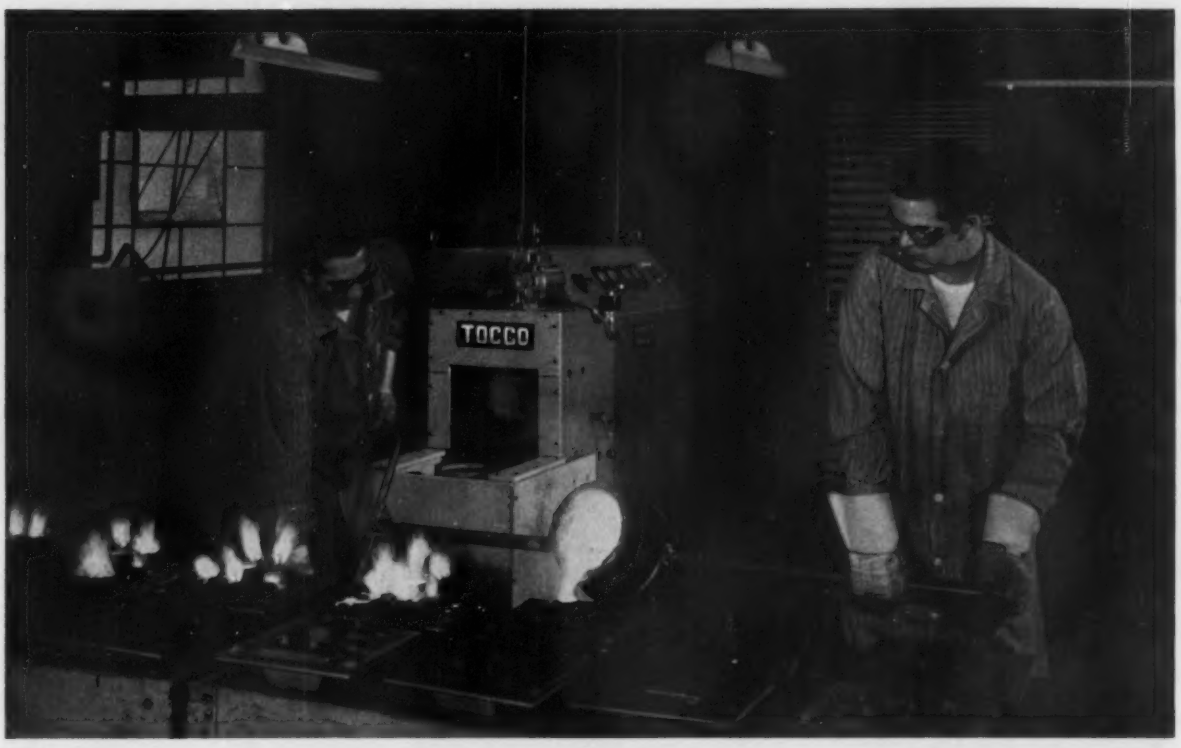
Aluminum alloy 360 was used to make these castings in a four-cavity die with angular cores and cast-in undercuts. The wall sections had to be free of surface defects and cracks, and the knife-edges of the castings had to be free of nicks. The parts were finished by glass-bead blasting and shipped to the customer in polyethylene bags.

Missile Part — The magnesium part made without draft was for a missile manufacturer. If draft had been used, the cost of removing it would have been so great that the customer was willing to purchase the dies and development time necessary to discover how to make these castings without draft. The part was half a cylinder, 5 in. in diam and 10 in. long, with extensive ribbing and a wall thickness of 0.060 in.

At first, graphite was used to lubricate the die so that the casting could be drawn out easily, but this procedure was dropped when it was found that the casting carried the graphite into the missile where it was harmful. Also, the temperature control cycle of the diecasting machine had to be adjusted so that the part could be stripped from the core before a shrinkage crack developed.

Because of these difficult problems, the production rate or low reject rate possible with parts with draft could not be attained. Nevertheless, the method still was the most economical one possible, and several thousand of these parts have been made.

Another diecasting had a protrusion 2½ in. long, 1½ in. wide, and ¾ in. thick which was cast without draft, although it projected into the cover half of the die. This part had to be sound, and periodic checks were made by x-ray. Casting the part this way saved a machining operation, and



TOCCO* Induction Heating

melts bronze, aluminum and stainless steel for high-precision, porous-free castings

Morse Instrument Company, Hudson, Ohio, manufacturer of marine hardware and control instruments, recently switched from conventional furnaces to TOCCO Induction Melting. Results: greater speed, better working conditions and, above all, purer, sounder castings.

"Castings are free from porosity since we switched to TOCCO Induction Melting," reports president John Morse. "This is a sales advantage to us and a tremendous quality advantage for our customers."

Whether you're interested in melting ferrous or nonferrous metals, TOCCO Induction Melting offers you these important advantages:

- **Stepless Power Control**
- **Extremely Rapid Melting**
- **High Efficiency—Even on Intermittent Operation**
- **Good mixing because of Natural Agitation**
- **Extremely Low Alloy Loss**
- **No Contamination when Composition of Charges is Changed**
- **High Reproducibility of Results**
- **Minimum Space Requirements**
- **No Special Installation Charge**
- **Simple, Safe Operation**
- **Clean, Comfortable Working Conditions**
- **No Carbon Pick-up**

If any of these advantages suggest economies in your operations, write for full details—no obligation, of course.

Sample castings produced by Morse Instrument Company with new shell molding process and TOCCO Induction Melting.

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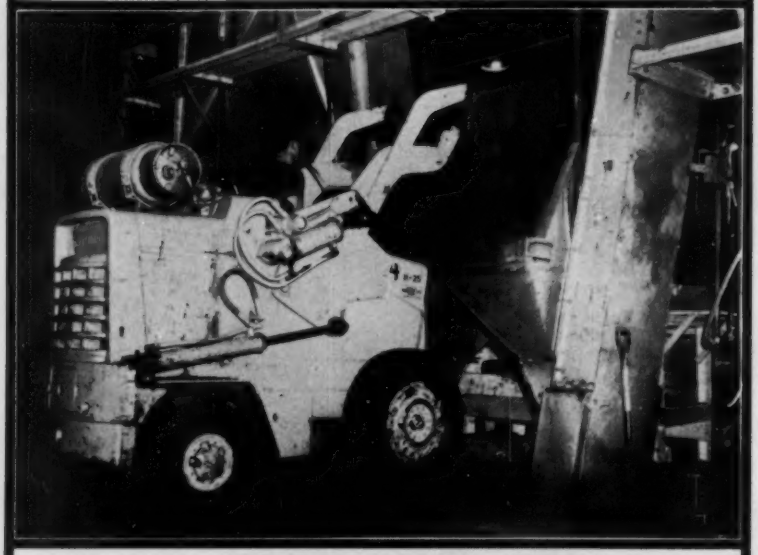
Sand handling system built



around 3 PAYLOADER® units

Davis & Furber Machine Company of North Andover, Mass., specializes in manufacturing textile machinery. Since 1952 this company has been a continuous user of "PAYLOADER" tractor-shovels on its foundry floor. Two Model HA's (2,000-lb. operating capacity) handle sand, move materials, remove cupola waste and the like. Recently the firm added Hough's new H-25 (shown) to its "PAYLOADER" fleet. This unit is used principally during the molding operation, bringing sand from storage to supply a 4-station sand system. At night it returns the sand from the muller to storage.

You will find that an H-25 "PAYLOADER" tractor-shovel will pay for itself very quickly in savings alone —

OPERATING CAPACITY — Its 2,500-lb. capacity is 25% greater than has ever been available in a tractor-shovel of this size. Yet, it shuttles around corners, through narrow aisles, doorways and crowded yards, up and down ramps with speed and safety.

MECHANICAL FEATURES — The H-25 has a full reversing, power-shift transmission (no clutching) with two speed ranges forward and two in reverse, torque converter drive, power-steering (6-ft. turning radius), power-transfer differential and fast, powerful hydraulic bucket control.

A HOUGH DISTRIBUTOR is nearby to show you how the Model H-25 or a larger "PAYLOADER" (up to 12,000-lb. operating capacity) can increase output and lower costs on your bulk handling requirements. Contact him today or return the coupon below.

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the cast skin was preserved.

Six-Cavity Die—The job with the plus or minus tolerance of 0.0005 in. across the parting line was a high-volume zinc diecasting. To meet this specification, the six-cavity die was made to a high degree of accuracy. It was heat treated, and its faces were ground in a jig. In this instance, as in the others, it proved to be more economical to make an accurate casting than it would have been to machine to dimensions.

One more example of dimensional control attained by Western Die Casting Co. was a set of identical diecastings designed to dovetail with each other so they could be used to put together room dividers. If only a few of the hundreds or thousands of castings in a divider were off, the entire unit would be thrown out of alignment. At first, single-cavity dies were used, but production went so well that three-cavity dies were built and used in a hot chamber diecasting machine. Now, after more than ½ million have been cast, the as-cast parts still slide together without secondary work.

Book Review

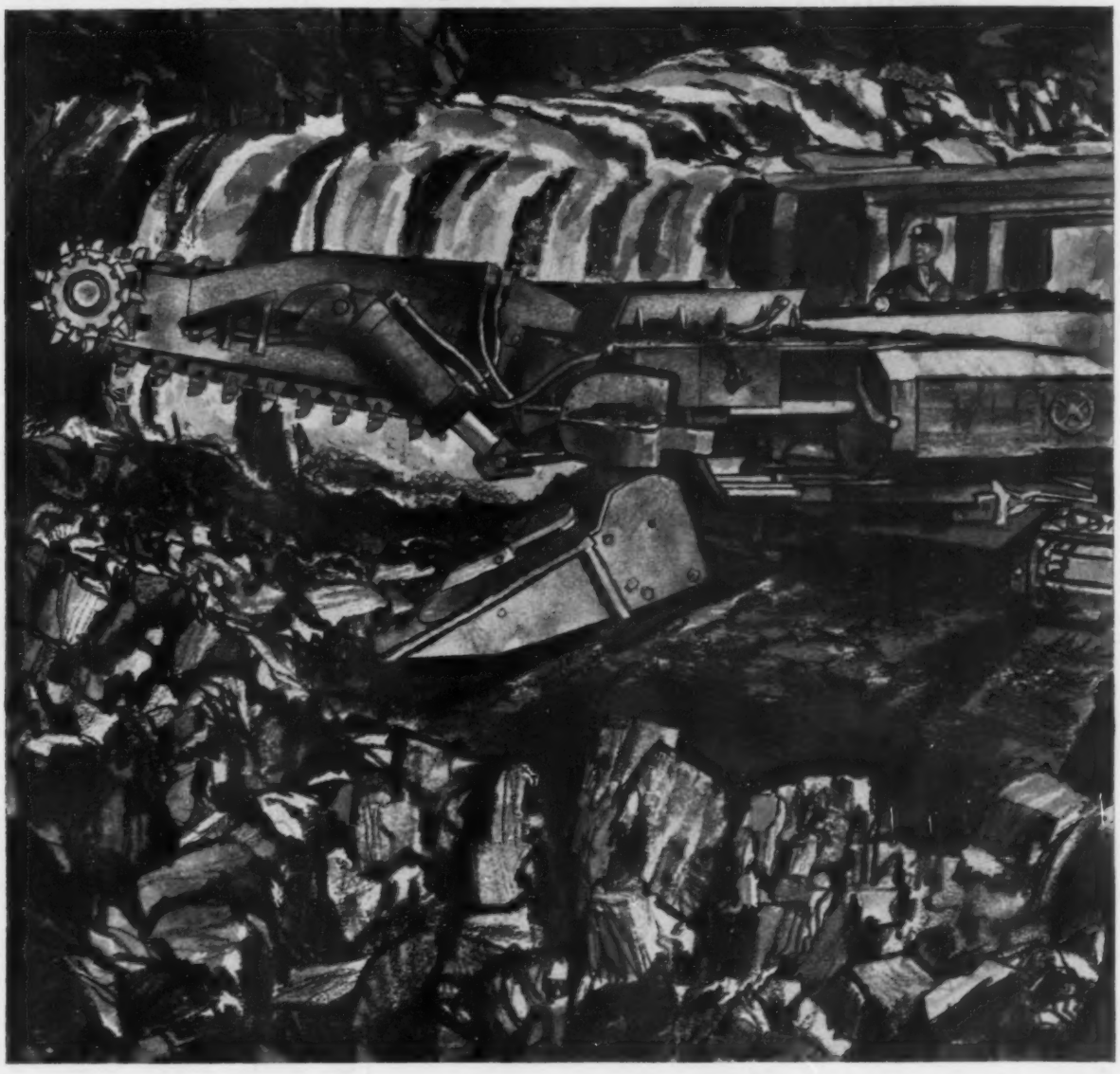
For the Years to Come, by John F. Thompson and Norman Beasley, cloth bound, 360 pages, 5½ x 8¼ in., published by G. P. Putnam's Sons, 210 Madison Ave., New York 16, N. Y. Price $5.

Book tells the story of International Nickel of Canada. It lays the background for the company's inception and growth by first describing the beginnings and development of the nickel-producing industry in Canada.

Nickel, one of Canada's most important minerals, was discovered in 1848 near Lake Huron. Several pioneers participated in developing processes to obtain nickel from its ores and in developing commercial uses for the metal.

International Nickel was incorporated in 1902, joining several Canadian companies engaged in mining and processing operations. Milestones in the company's history from its founding to the present are described. These include the development of Monel metal and other nickel alloys, use of nickel steel armor plate for ships, and the use of nickel alloys in automobiles.

Birth of a Gray Iron Casting—No. 2



SELECTION OF COAL

Coal selection, washing and blending are elementary but vitally important steps in the production of foundry coke. Today, modern mining equipment and efficient cleaning methods enable the coke producer to utilize highest quality coals for coking purposes.

From the rich deposits in Kentucky and West Virginia, Pittsburgh Coke & Chemical Company utilizes coals containing a high percentage of low volatile Pocahontas to produce Neville Foundry Coke. This strong, dense, uniform coke; controlled through every step of production, has more fixed carbon, less ash and sulphur content.

The use of Neville Foundry Coke produces better, cleaner, more fluid iron—the type required by the foundry to produce the wide variety of fine gray castings so important to this nation's industry.

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Neville Pig Iron and Neville Coke for the Foundry Trade

FOUNDRY DEVELOPMENTS

By EDWIN BREMER
Metallurgical Editor

Quality Aluminum

ALUMINUM castings with improved strength and ductility can be produced by careful control of foundry variables, particularly iron contamination, process variations, and specialized heat treatment, according to a report, "Application of High-Strength Aluminum Castings" by Slawsky and Heiser. The report is designated PB 171,564 and may be obtained from the Office of Technical Services, U. S. Department of Commerce, Washington 25, for 75 cents. Processes used in the study were the permanent mold technique employing an anodized aluminum mold, and chilled shell molding using aluminum chills to effect localized rapid solidification.

High-Strength Steel

MECHANICAL properties of high-strength steels can be increased by lowering the sulfur content to 0.001 to 0.002 per cent through inoculation with Ca-Mn-Si under conditions of high slag basicity, according to tests conducted by the Army Ordnance Corps. Tensile test bars of treated 4325 and 4340 steels showed improved ductility and toughness compared with normal sulfur steels at the same strength levels.

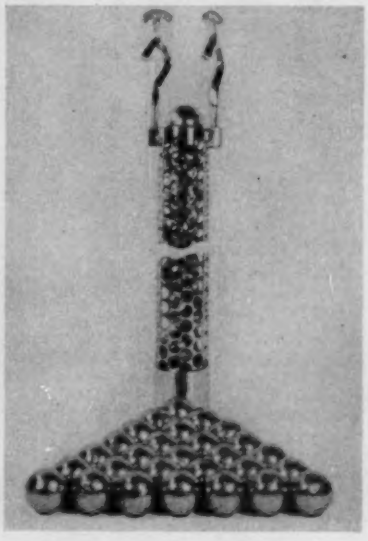
Details are available in report PB 171,384, "Desulfurization by Calcium Inoculation Improves Properties of Cast Steel" by Colling and Ahearn, which may be obtained from the Office of Technical Services, U. S. Department of Commerce, Washington 25, for 75 cents.

Elevated Temperature Use

IN A REPORT, "Creep Tests on a Flake Graphite Cast Iron at 350° C," by Palmer in the July, 1961 issue of *BCIRA Journal* (Birmingham, England), the results indicate that unalloyed gray iron can be used advantageously at temperatures up to 650°F. The stress to produce 0.1 per cent creep strain in 5000 hours is 17,472 psi at 662° F (350° C). Previous tests at 400° C (752° F) showed the 0.1 per cent creep strain to be produced by a stress of 9408 psi.

Nickel Electroplating

DIECASTERS doing nickel electroplating will be interested in a new concept which is reported to provide efficient use of the nickel anodes. As shown in the accompanying illustration, the nickel anode material is in the form of balls or beehives about



2 in. in diam. They are inserted in a perforated cylinder or basket made of commercially pure titanium sheet. It is said that the titanium will not corrode in the usual nickel bath and does not require any maintenance. The system was developed by Univertical Corp., Detroit.

Bismuth Mold Wash

INVESTIGATION of bismuth as a mold coating is described in "Effect of Bismuth Mould Wash on the Soundness, Structure and Properties of Grey Iron Castings" by M. J. Clifford in the May issue of *BCIRA Journal*. The wash consists of 10 per cent by weight suspension of metallic bismuth in an aqueous slurry with 10 per cent bentonite.

It was found that the bismuth mold wash appears as effective as tellurium mold wash in reducing local unsoundness. It differed, however, in that it had no effect on the breath of the operators, and caused less local chill, abnormal graphite, and reduction in the strength of the iron. It caused a slight decrease in eutectic cell number whereas tellurium increased the eutectic cell number. Use of bismuth mold wash must be controlled as carefully as that of tellurium washes.

Light Provides Heat

REQUIREMENT of high-level illumination of 200 footcandles in its drafting department led Akron Standard Mold Co., Akron, to have its architect design a well insulated building to take advantage of the heat generated for winter heating of the quarters. Ducts above the fluorescent lights draw the heated air from the lights and return it to the room according to thermostat demands. In summer the heated air is vented to the atmosphere.

AEC Reports Available

RESEARCH reports released by the Atomic Energy Commission which may be obtained from the Office of Technical Services, U. S. Department of Commerce, Washington 25, include the following:

"Some Attempts To Cast Centrifugally Fuel Elements of Small Diameter"—ANL-6177, price 50 cents; "Film Growth on Aluminum in High-temperature Water"—ANL-6230, price 50 cents; "High-temperature Niobium-base Alloys for Sodium-cooled Reactors"—MBI-1513, price 75 cents; "Mechanical Properties of Irradiated Zirconium, Zircaloy, and Aluminum"—DP-527, price $2.25, and "Summary Report on the Corrosion of Aluminum in High Temperature Dynamic Water Systems" —HW-59778 (rev.), price 50 cents.

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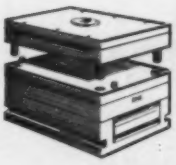

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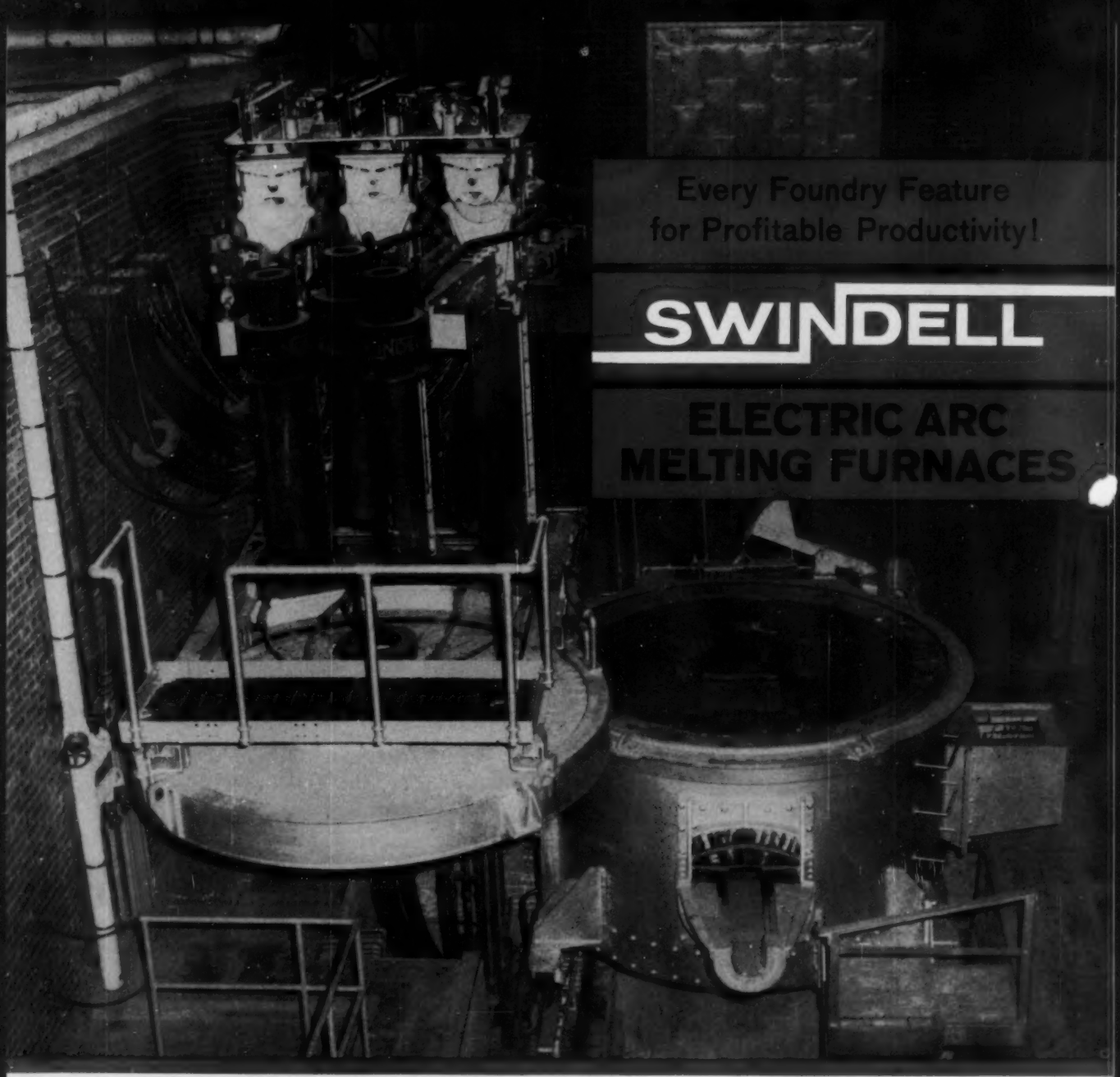

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For More Information Circle 617, Page 39

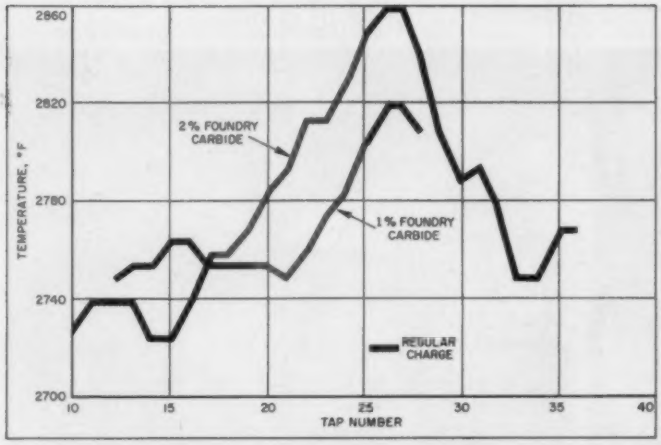


Fig. 1—One per cent carbide addition raised iron 60° F; 2 per cent addition raised it 100° F

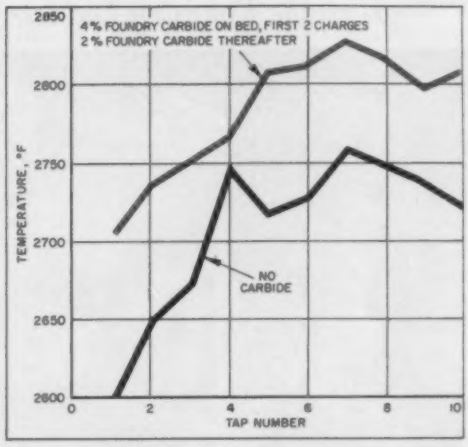


Fig. 2—Four per cent carbide on bed raised metal 100° F; then 2 per cent additions kept it up 70° F

Foundry Carbide Produces

HOT, FLUID IRON

● IRON flowing from the cupola at a temperature of 2800° F or higher usually is of better quality than colder iron. The metal is more fluid, improving castability, and slag separation is more nearly complete.

High temperatures during melting also improve cupola operations by preventing bridging, reducing oxidation of silicon and manganese, improving analysis control, and increasing carbon absorption. Thus, larger amounts of steel scrap and other low-cost materials can be charged.

In recent years, many foundries have obtained higher metal temperatures and their related advantages by preheating the cupola blast. Recently, a new exothermic material, EM foundry carbide, manufactured by Union Carbide Metals Co., has been developed to allow operators of cold-blast cupolas to obtain many of these benefits.

Foundry carbide is a special calcium carbide which, when charged into the cupola, melts and burns in the coke bed. Liquid drops of carbide burn vigorously, giving off heat as they pass through the combustion zone and forming a shallow zone of extremely high temperature just above the tuyeres. Iron passing through this zone becomes very hot.

As it burns, foundry carbide forms carbon dioxide and molten lime. The lime carries the heat of this reaction into the slag, where it helps raise the iron temperature in the hearth. The carbide also creates a reducing condition in contrast to the conventional fluxing action of limestone.

Foundry carbide replaces lime-

Fig. 3—Carbon absorption and silicon recovery went up despite reduced coke; iron replaced by scrap

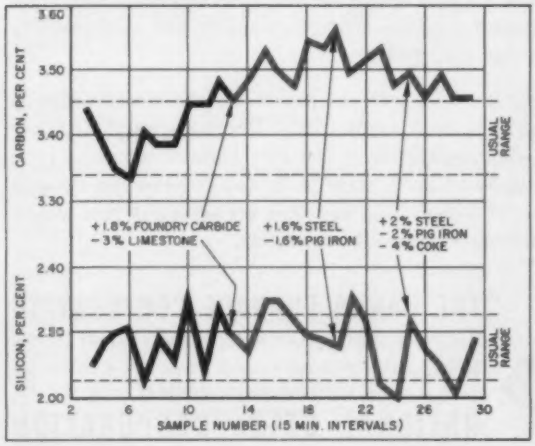
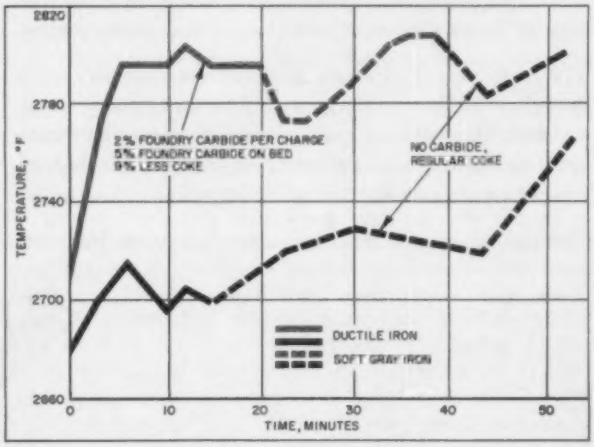


Fig. 4—Graph shows effect of carbide added to an acid-lined 72-in. cupola with 8000 cfm cold blast



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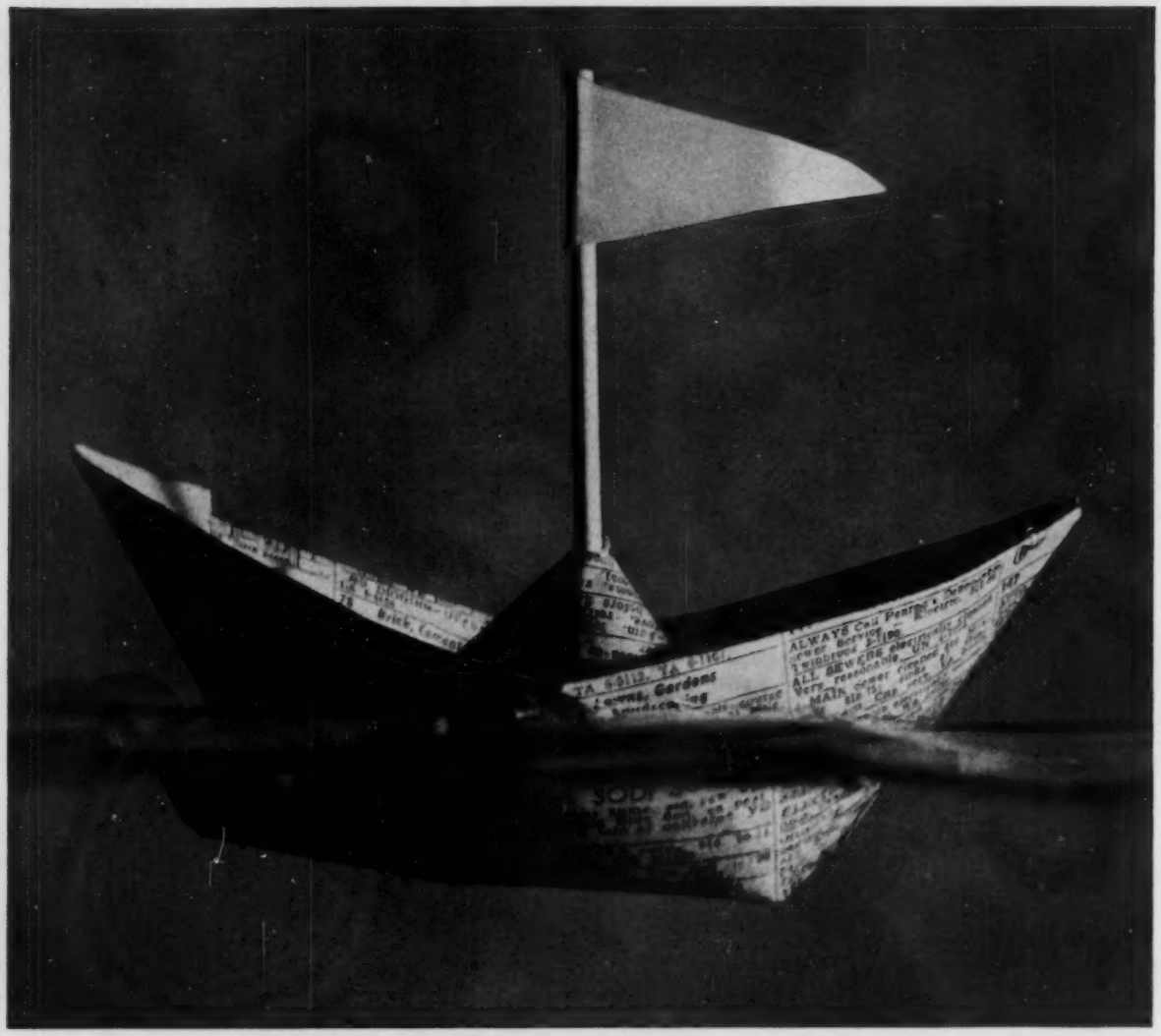

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It's the lightest thing afloat. But lightness alone isn't quite enough, is it? Because the paper will get soggy and the boat will sink. Of course, we could process the paper and waterproof it. But why not save added expense and complexities by sticking to a material that's *naturally* suited to boat hulls?

Castings, too, can be made with lighter materials. But even complicated, costly "toughening up" processing won't give some lightweight metals the wear resistance, heat resistance, dampening qualities, strength, stability and machinability of reliable iron castings.

So why not stick with the proven material that's *naturally* suited to so many applications? Design engineers, together with their colleagues in the iron foundry industry, have already found many ways to lighten iron castings through improved design. This way they are achieving new weight reductions, economically and safely.

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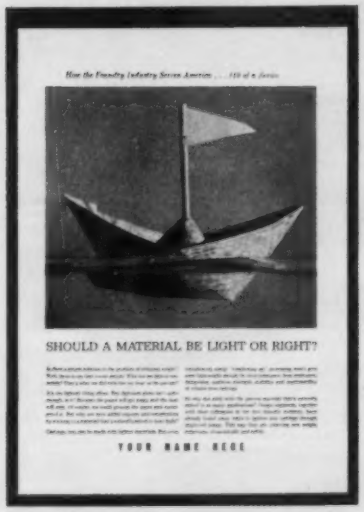

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stone, the usual source of lime in the slag. (The limestone reaction absorbs heat.) Since foundry carbide contains 50 per cent more calcium than limestone, the slag composition will remain unchanged if 2 lb of carbide replace 3 lb of limestone. Slag formed by foundry carbide is very fluid.

Advantages — Foundry carbide was developed in West Germany, where today over 150 foundries use it regularly, but now is being produced in the United States. Extensive tests in U. S. foundries have confirmed the advantages found in Germany. Here's what they found:

Higher Temperatures — Fig. 1 shows that 1 per cent foundry carbide by weight of the metal charge raises iron temperatures 50 to 60° F, and 2 per cent foundry carbide adds 100° F.

Hot Startups—The resulting hot cupola startups cause the first iron tapped to be fluid enough to be poured into castings and need not be pigged. Fig. 2 shows that by adding 4 per cent foundry carbide to the coke bed, the first two charges yielded iron that was 100° F hotter than normal. Metal temperature then increased quickly. When foundry carbide was used throughout the heat, metal temperature also recovered rapidly after shutdowns.

Some foundries use foundry carbide only at the start of a heat and before planned shutdowns such as lunch time. By timing carbide additions to reach the coke bed just as the blast is shut off, metal temperatures will climb quickly after startup.

Carbon Absorption—Fig. 3 shows that 1.8 per cent foundry carbide improved carbon absorption and silicon recoveries. When 1.8 per cent carbide was added, the carbon content rose about 0.15 per cent. These higher carbons allowed the coke charge to be reduced 4 per cent and permitted 13 per cent of the pig iron to be replaced with steel scrap.

Even with less carbon being charged, the carbon analysis remained 0.07 per cent higher than before the carbide was added. Meanwhile the silicon content remained high even though about 0.07 per cent less silicon was being charged due to the reduction in pig iron. The average metal temperature during this use of foundry carbide was 2860° F—a 60° increase over the already high temperatures reached before the carbide was added.

Melting Rate—If a cupola has a low charging level or inadequate blower capacity, an increase in melting rate often is desired. Because of the higher temperatures produced by this carbide, the coke charge can be reduced as much as 20 per cent with a similar increase in melting rate.

Lower Sulfur—A major portion of ductile iron is made in basic cupolas since basic slags effectively remove sulfur and reduce the cost of the magnesium treatment. Foundry carbide improves the desulfurizing power of the basic slag.

Acid melters have more of a sulfur problem. Since acid slags don't desulfurize, they must use low-sulfur raw materials that are high in carbon and low in phosphorus. By increasing the metal temperature, foundry carbide boosts carbon absorption and permits use of more steel scrap. These high temperatures also allow heavy desulfurization by calcium carbide injection or soda ash ladle additions without making the iron too cold to pour.

Fig. 4 shows that 2 per cent foundry carbide increased the temperature of acid-melted ductile iron made at the start of a heat by 85° F. Also, 5 per cent foundry carbide added to the bed gave a fast temperature rise. As might be expected from these high temperatures, carbon absorption and silicon recovery improved.

Even with the coke reduced 9 per cent, ductile iron carbons ran 3.96 per cent versus a normal of 3.70 per cent. Silicon reached 1.73 per cent versus a normal of 1.51 per cent. Since these analyses are high, more steel scrap can be charged to get the desired range at some savings in material costs.

Although foundry carbide will not convert an acid slag into a desulfurizing basic slag, it does aid sulfur reduction in two ways. Slags will hold more sulfur because they have a higher temperature and lower iron oxide content. Also, since coke is a major source of sulfur in cupola melting, less sulfur will be introduced if foundry carbide is used to reduce the coke charge necessary.

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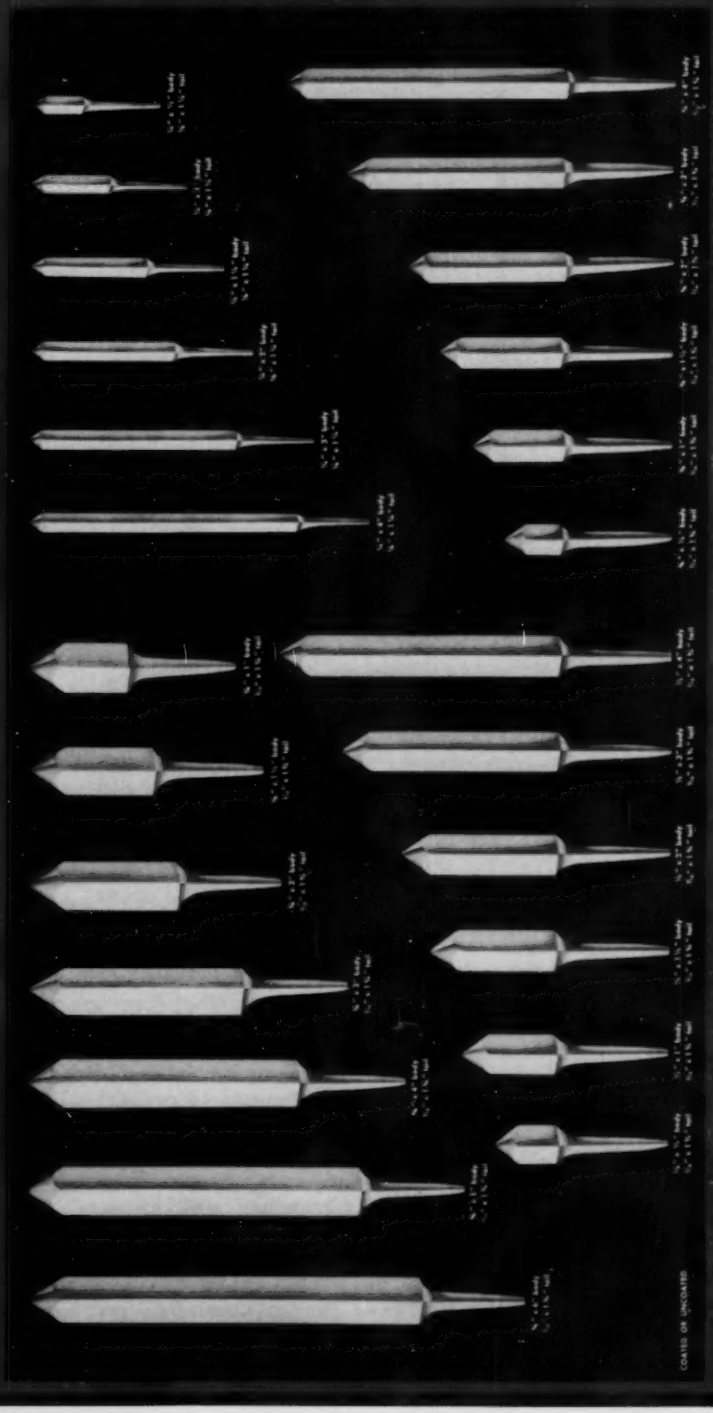


Five FANNER FAN-S-CHILLS

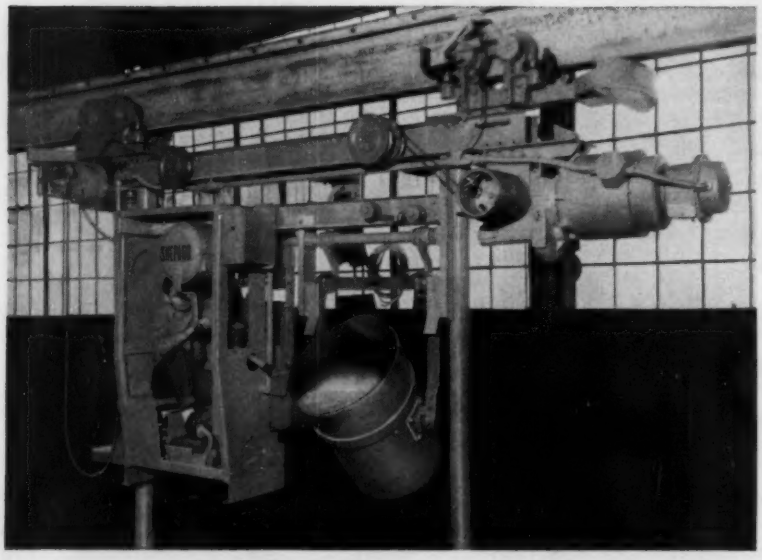
AT IT . . .
REQUIREMENTS
LOWEST COST

This handy wall chart (22" x 35") is another FANNER service designed to help you satisfy your chill requirements better . . . faster . . . and at lowest cost. FANNER offers the most complete line of chills in the industry — a type for every casting need. Write for further information.

FREE COPY OF WALL CHART ON REQUEST.

The Fanner Manufacturing Co. • Brookside Park • Cleveland 9, Ohio

JOB-MATED



for Hot Metal Handling

Shepard Niles Hot Metal Carrier

It only takes **one man** to move and pour hot metal — swiftly and safely — with a Shepard Niles Hot Metal Carrier. And because each carrier is **JOB-MATED** — built with the components best suited to meet **your** exact on-the-job conditions — it will last longer, require minimum maintenance and practically no downtime. Care like this in our plant means significantly lower cost operation in yours.

For full details on this labor-saving method of low-cost handling, write for latest bulletin. Ask to have a Shepard Niles representative call.

America's Most Complete Line of Cranes and Hoists

Member of Hoist Manufacturers Association, Inc.

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1373 Schuyler Ave., Montour Falls, N.Y.

Michigan Foundry Conference To Stress New Developments

Annual AFS Michigan Regional Foundry Conference will stress new developments in molding, melting, materials, design, and marketing. The two-day meeting will be held at Kellogg Center, Michigan State University, East Lansing, Mich., on Thursday and Friday, Oct. 19-20. The annual banquet on Thursday evening will be held in Hotel Jack Tar, Lansing, Mich.

Donald Dice, Albion Malleable Iron Co., is program chairman for the conference. General chairman is Jerome R. Young, Cadillac Motor Car Div.; John E. DeGroot, Benfur Engineering Co. is secretary; Eugene Passman, Frederic B. Stevens Inc., is treasurer, and Jess Toth, Harry W. Dietert Co., is permanent executive secretary and treasurer.

Program details follow:

Thursday, Oct. 19

8:30 a.m.—Registration.
9:30 a.m.—Welcome. Dr. Austen J. Smith, head, Dept. of Metallurgical Engineering, Michigan State University.
9:45 a.m.—Permanent Mold Castings, Harry McMurray, Ford Motor Co.
10:45 a.m.—Panel discussion, **Future Trends in Casting Tolerances.** Metal Composition, Robert W. Gardner, manager of quality control, Dearborn Iron Foundries, Ford Motor Co.; Molding Techniques, Theodore R. Schroeder, foundry superintendent, Pontiac Motor Div.; Coremaking, Frederick J. Hodgson, chief product engineer, Eaton Mfg. Co., Foundry Div.; Pattern Equipment, Victor A. Pyle, Pyle Pattern & Mfg. Co.; Machine Shop Requirements, C. William Yaw, assistant superintendent of machining and heat treat, Cadillac Motor Car Div.
12 Noon—Luncheon, **Management vs. Compensation Problems,** F. A. Warner, assistant general counsel, Auto Owners Inc.
1:30 p.m.—Hot and Cold Box Coremaking Using Chemical Setting Core Binders, Joseph Cummings, corerooom superintendent, International Harvester Co.
2:30 p.m.—Hydraulic Approach to Gating, John Wallace, Case Institute of Technology, Cleveland.
3:30 p.m.—Mold Control in Medium-Sized Foundries, T. H. Hanna, technical representative, Harry W. Dietert Co., and Albert F. Tankovich, foundry superintendent, Midwest Foundry Co.
6:00 p.m.—Banquet. Guest speaker, Dr. V. Dewey Annakin.

Friday, Oct. 20

8:00 a.m.—Registration.
8:30 a.m.—New Market Oportunities for Metal Castings, Jack H. Schaum, editor, *Modern Castings.*
9:45 a.m.—A New Look at Plastic Patterns for High Production, Robert Simon, pattern shop supervisor, Saginaw Malleable Iron Plant, and William Weaver, president, Modern Pattern & Plastics Inc.
10:45 a.m.—Student Session, **Challenge of the Foundry Industry to the College Student,** R. Dobbins, plant manager, Albion Malleable Iron Co.

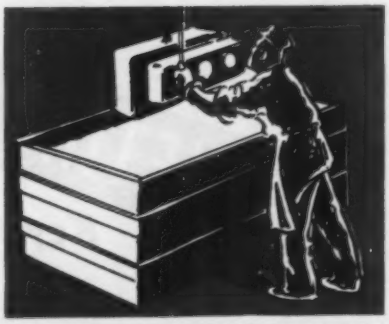
Group Discussions: **Ductile Iron,** James Graham, Ford Motor Co.; **Malleable Iron,** Price Burgess, Albion Malleable Iron Co.; **Cupola Operation,** Richard Dixon, Cadillac Motor Car Div.; **Shell Molding,** Wm. Sutties, Beardsley & Piper Div.; **Dies, Molds, Patterns,** John Zatalokin, Monarch Pattern Co.; **Ferrous Castings,** David Sherman, Engineering Castings Inc.; **Foundry Sands,** Charles Cousineau, Carpenter Bros. Inc.; **Nonferrous Castings,** Kenneth Nelson, Wellman Bronze & Aluminum Co.; **Plant Engineering and Maintenance,** Dale Brautigam, West Michigan Steel Castings Co.
11:45 a.m.—Luncheon, **Western Michigan University,** T. T. Lloyd, vice president, Albion Malleable Iron Co.
1:30 p.m.—Plant Tour, Oldsmobile Div., General Motors Corp., Lansing, Mich.

DELTA MAKES A COMPLETE LINE OF CORE AND MOLD WASHES FOR ALL SAND CAST METALS

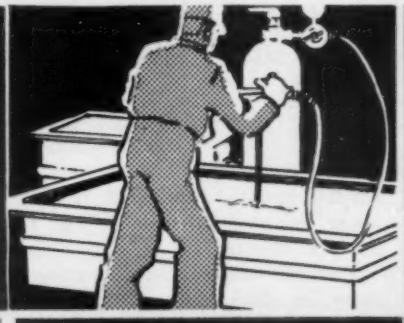
. . . in every convenient form . . . PASTE, DRY POWDER, LIQUID, ready to mix with WATER or ALCOHOL for immediate use by dipping, brushing or spraying.

DELTA CORE and MOLD WASHES are made with SILICA, GRAPHITE, ZIRCON, OLIVINE, etc. for the specific needs of foundries casting gray iron, steel, malleable, non-ferrous metals.

There is a DELTA wash . . . foundry tested and proved-in-use . . . for every casting requirement regardless of size, shape or metal poured.



SPEED PRODUCTION OF FINER-FINISH CASTINGS



CUT CLEANING ROOM COSTS

REDUCE SCRAP & REJECT CASTINGS TO A MINIMUM

LOWER PRODUCTION COSTS

GIVE CORES & MOLDS BETTER DIMENSIONAL STABILITY

over quarter of a century

DELTA

GOOD TO THE CORE

DELTA FURKOAT WASH

for furan resin-type cores.

Developed by Delta research chemists for use on cores made with all high speed coremaking methods.

Working samples of Delta Foundry Products, together with information regarding their use, will be sent to you upon request.

DELTA OIL PRODUCTS CORP.

MANUFACTURERS OF

SCIENTIFICALLY CONTROLLED FOUNDRY PRODUCTS

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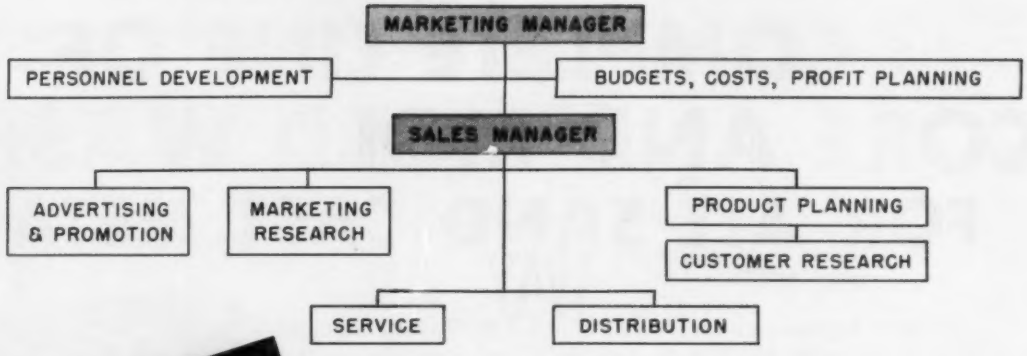
PROPOSED MARKETING ORGANIZATIONAL CHART FOR A FOUNDRY



MARKETING— Key to Profitable Foundry Operations

By LOUIS IANNETTONI
and
JAMES J. BLAHA
Buffalo Div.
Westinghouse Electric Corp.
Buffalo

● FOUNDRIES are dependent on cyclic business trends whether they be seasonal or general economic fluctuations. During the so-called dips in the curve, foundrymen become more sales minded. When business is good, efforts generally are devoted to production and the sales and marketing program is neglected. This practice can lead to serious set-backs.

A foundry may have competent technical skills and efficient cost controls, but these are of no benefit without dollar - producing sales. Therefore, sales may be considered the life of foundry activity, and the importance of marketing and the proper programming of this function must be realized.

The foundrymen's approach to marketing, because they supply a service to industry, should be different from that of selling standard products or commodities. To sell castings it is necessary to do a marketing job and a selling job.

Selling vs. Marketing—The basic selling philosophy hasn't changed in the last thirty years. The selling idea is concerned only with meeting the needs of the seller; that is, converting his products to dollars, whereas the marketing philosophy focuses on the needs of the customer. Marketing determines what the customer wants and then satisfies his needs. Marketing is customer oriented whereas selling is product oriented.

Example—Sales-minded management, in effect, tells the sales department, "You sell the castings; we'll worry about profits!" On the other hand, a marketing-minded management tries to create value-satisfying goods and services that casting buyers will want. The casting industry, or any other, is a customer - satisfying process — not solely a casting-producing process.

The casting industry should devote more emphasis to marketing than to selling a casting. Selling should not be neglected, however, since it is an important aspect of marketing and provides an efficient tool for the marketing-minded foundries.

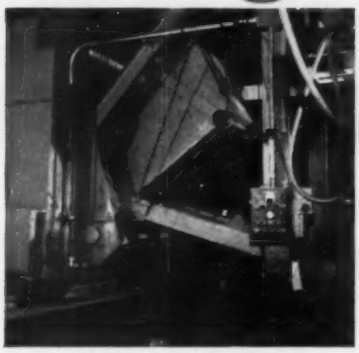
What Is Marketing?—The essence of marketing lies in finding out and discovering more about what the customer wants and needs. The way to this information is through the fundamental marketing tools of research and analysis. Marketing research, as defined by the American Marketing Association, is "the gathering, recording, and analyzing of all facts about problems relating to the transfer and sale of goods and services from producer to consumer."

Market analysis, consumer research, sales research, and advertising research are all important parts of marketing research. Research offers the natural way to find out: 1. Who your customers are. 2. Where they are located. 3. What they want or need. 4. When they will buy your products. 5. How much they will pay for them.

Who Your Customers Are—The following is a typical example: A few months ago, a foundry was persuaded to undertake a survey of users of the type of castings it produced. Sales management was reluctant. It contended it had good information on all users through their prospect list, that their salesmen regularly called on all companies on the prospect list and fed back all the data needed. A mail survey showed that a large percentage of the companies on the prospect list did not use the type of castings the foundry made. A second study is turning up prospects for sales the company did not even suspect existed.

Where They Are Located—Statistical data are available from various sources, such as government

automated SUPER tumblast® delivers THREE-WAY savings



This Wheelabrator Super Tumblast operates automatically through loading, blasting and unloading cycles. Skip-hoist is designed to accommodate tote boxes for handling unit loads.

A demonstration of WHEELABRATOR'S

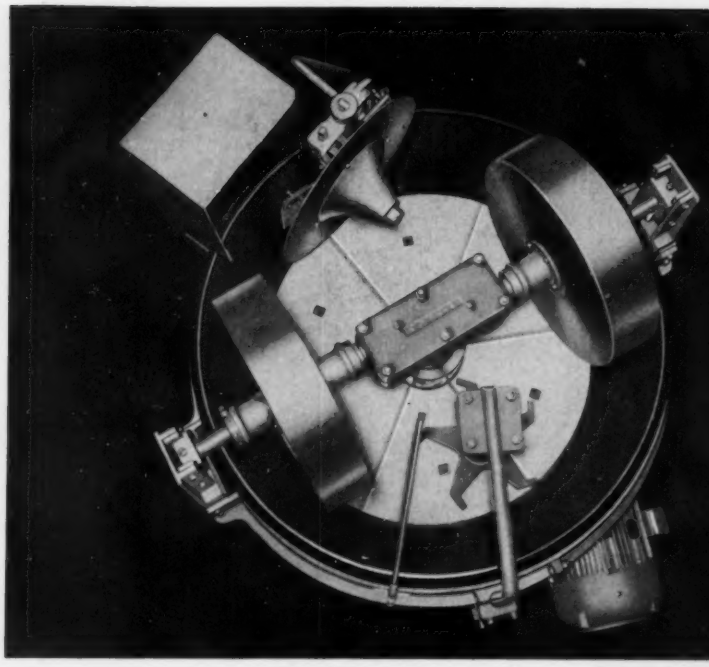
VITAL VALUES

Management at General Foundry & Mfg. Co., Flint, Michigan, can count three important areas of savings, as a result of rearranging their cleaning room around a 22 cu. ft. Wheelabrator Super Tumblast. First, more thorough cleaning permits improved inspection, for increased precision and quality. Second, cleaning cycles have been cut almost in half. Third, the automated operating features of the Wheelabrator blast machine have made it possible to reduce the cleaning room crew from six men to three. Such multiple economies are typical of the vital savings you can expect with Wheelabrator equipment. Get the new Super Tumblast story by writing for Catalog 162-D.

VITAL VALUES FOR INDUSTRY

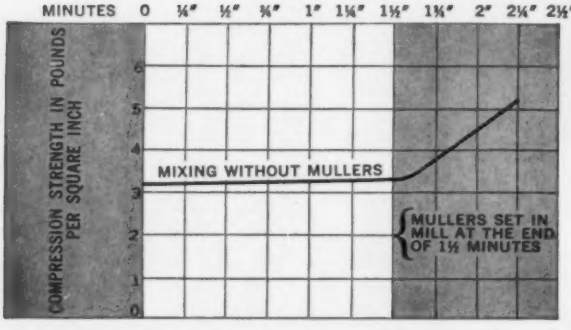
WHEELABRATOR
AIRLESS BLAST EQUIPMENT

WHEELABRATOR CORPORATION, 505 S. Byrkit St., Mishawaka, Indiana. In Canada, WHEELABRATOR CORPORATION OF CANADA, LTD. 1901 Birchmount Rd. P.O. Box 490, Scarborough, Ontario
A subsidiary of Bell Intercontinental Corp.



Muller Mixing Increases Sand Strength Greatly . . . Rapidly!

Sand Strength Curve Proves the Difference



This Strength Curve Chart demonstrates how much more effective muller mixing of sand is over regular scraper type mixing. In this test a Clearfield mixer was used to mix a charge of 91% burned sand, 3% bond and 6% water. At the start of the run the mulling wheels were removed completely . . . the batch was charged and the mixing operation continued for 1½ minutes with only the disc and agitator operating on the material. *There was only a slight increase in the strength of the sand.* Then the mullers were set into the machine and operation on the same batch continued for 1¼ minutes. During this very short period with the mullers operating, *the sand strength increased very rapidly.* You can speed production, with assured quality results—and cut costs too—with a Clearfield muller-type mixer. *Let us prove the superiority of Clearfield Muller-type Mixers with a sample run of your own batch. Just call us.*

WITH its speed, dependability and special mixing features, a Clearfield Mixer prepares your sand properly and exactly as you want it . . . thus paying for itself many times over. In addition to the strength-building mullers, Clearfield Mixers have other features that assure quality results every time. First, all Clearfield Mixers work on the rotating pan principle so that every particle in the batch is kept in continuous motion, with the ingredients alternately spread and gathered together to maintain highest mixing efficiency.

Another feature is the patented star-shaped agitator which covers the entire flat surface of the revolving bottom and prevents material from forming hard cakes or lumps. The agitator is driven automatically by the force of the sand being rotated by the pan motion; a "whirlpool" action is created, speeding up the mixing process and promoting clean emptying of the pan.

The Clearfield double-duty disc, also patented, cuts all the material free from the revolving pan rim at each revolution, turns it over and diverts a continuous roll of material under the mullers. (Moved to the discharge position, this disc unloads the complete batch in 15 to 20 seconds!)

You get thorough, proper blending and mixing when you use a Clearfield Mixer.

for complete details about the wide variety of Clearfield Mixers, write for Catalog No. 90

CLEARFIELD
MACHINE COMPANY
CLEARFIELD, PENNSYLVANIA, U.S.A.

agencies, trade associations, trade journals, internal records, etc. This information can show a foundry whether it is getting the proper share of the market and concentrating sales in the areas of greatest potential.

What They Want or Need—Through marketing research, a survey can be made to determine customers' wants and needs. Two basic methods can be used to accomplish this:

a) An internal analysis of the company's own business records, such as cost and sales records.

b) An external analysis, usually utilizing the personal survey, mail survey, and telephone survey.

When They Will Buy—Data that can be correlated with casting sales indicate when customers will buy. This information usually is a broad indication and is only an average of the over-all picture. Market analysis for your specific company will show how you fit into this picture.

How Much They Will Pay—Many companies become top heavy with scientists and engineers. This creates a bias toward research and production and apathy toward marketing. The organization tends to view itself as making things rather than satisfying customer needs. Foundry engineers may have a tendency to overdesign a casting from the quality, material, and functional aspects. The casting that best will satisfy the customer's needs is the one he will purchase. Again, careful market research will provide this information.

We must remember that there are only two basic processes in our economy: (1) Production or the creation of goods and services and (2) marketing or the activities by which goods and services flow from the producer to the ultimate consumer.

To illustrate the broad functions of marketing, we quote the basic philosophy of the Westinghouse Electric Corp.:

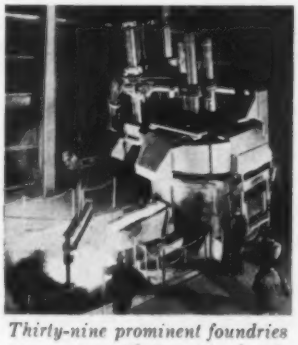
"The entire organization (research, engineering, production, and marketing) must work together to determine what the customer wants, how best to produce it, how to motivate its sales, and how to deliver it. To achieve this over-all

Double savings in electric furnace fume control

A demonstration of WHEELABRATOR'S

VITAL VALUES

Hundreds of pounds of foreign matter are removed daily from the atmosphere in each of the 54 Wheelabrator electric furnace fume control systems installed in prominent steel foundries. This quantity of dust and fume is removed at a double savings as a result of the Vital Values incorporated in each system. They provide the necessary efficiencies at a savings in initial costs compared to other possible methods. They repeat the savings daily because they are so much less costly to operate. A choice of hooding methods tailored to individual furnace requirements providing complete flexibility, no visible solids in the effluent gases and rock-bottom operating and maintenance costs are some of the Vital Values you get only from Wheelabrator.



Thirty-nine prominent foundries are now ventilating 54 electric furnaces with Wheelabrator fume control systems, handling a combined total of over a million c.f.m. of air. Send for full details.

WHEELABRATOR

DUST AND FUME CONTROL

VITAL VALUES FOR INDUSTRY

WHEELABRATOR CORPORATION, 505 S. Byrkit St., Mishawaka, Indiana.
In Canada, WHEELABRATOR CORP. of Canada, Ltd. P.O. Box 490, Scarborough, Ont.

BOOST PRODUCTION UP TO 25%

MANHATTAN REINFORCED CUT-OFF WHEELS

"MORE USE PER DOLLAR"

- **MORE CUTS AT LOWER COST**
- **FASTER PRODUCTION**
- **GREATER SAFETY**
- **CUSTOM-MADE FOR YOUR JOB**

Job records prove these wheels take the abuse of heavy cutting in foundry operations—far beyond the limits of ordinary cut-off wheels! Here's why:

MANHATTAN REINFORCED CUT-OFF WHEELS ARE REINFORCED TWO WAYS

1. Special fibers in Manhattan's Bond increase by 50% the wheel's strength to withstand destruction by centrifugal force.
2. Super-strength synthetic lateral reinforcement gives a degree of resistance to side-strain not possible with ordinary wheels.

DOUBLE REINFORCEMENT ADDS UP TO DOUBLE SAFETY—AND PROTECTION FROM BREAKAGE, TOO!

Let a Manhattan sales engineer show you how to get "More Use per Dollar" with Manhattan Reinforced Cut-Off Wheels and other types of Manhattan high speed, heavy duty wheels.

RM-1064

ENGINEERED RUBBER PRODUCTS ... MORE USE PER DOLLAR

RM

WRITE TO ABRASIVE WHEEL DEPARTMENT

MANHATTAN RUBBER DIVISION • PASSAIC, NEW JERSEY

RAYBESTOS-MANHATTAN, INC.

goal, each division is bound into the over-all plan and its contributions clearly delineated. Simultaneously, marketing and production research are specified at each phase of the cycle, leading from initial customer indications of what they want to their ultimately being sold what they want. Each individual research study is co-ordinated with the other elements of the program and becomes a part of the whole structure of marketing knowledge."

Start with Marketing

The following chart of a typical marketing cycle illustrates the importance of such a program. The marketing man should be brought in at the beginning of the cycle instead of at the end. The resulting communications set up by this plan relay information to the various foundry departments which finally is incorporated into the product. Thus, we should be "working back from the market." Sales is concerned mainly with the needs of the foundry and is not customer oriented. Its only concern is in selling the castings it now has.

Marketing Philosophy
Marketing Research
Customer
Product Planning
Production
Marketing
Customer

Selling Philosophy
Production
Sales
Customer

The chart at the beginning of this article illustrates a marketing-oriented foundry. In many smaller foundries, the listed functions would be assimilated by a combination of responsibilities under one person. No matter how small the foundry is, it is important to recognize these necessary functional areas of marketing.

Sound marketing strategy often consists of not doing what competitive foundries already do, but doing what they are not doing by having something original to offer. In conclusion, it can be said that a prime prerequisite to a profitable foundry operation is to find out what the customers want and then to do all that is possible to satisfy these wants.

comparative tests prove Wheelabrator steel abrasive costs less

Typical test based on use of S-550 Shot, .017" Removal Size, 20 H.P. Motor, Nominal Abrasive Loss	Consumption Lbs. Per Hour	Cost Per Wheel Hour
WHEELABRATOR STEEL SHOT	7.4	70¢
STEEL A	9.9	89¢
STEEL C	8.55	79¢
STEEL D	9.25	81¢
STEEL R	10.7	91¢
MALL. G	13.5	$1.01
MALL. P	18.5	$1.20

PROVIDES LOWEST TOTAL BLAST CLEANING COSTS

In over 5000 field and laboratory tests, top quality Wheelabrator steel abrasive has demonstrated its ability to provide lowest possible total blast cleaning cost. True abrasive value is determined by the amount of work it will do in a given time, the quality of the finish, and the cost of performing it. Wheelabrator steel abrasive excels in all three factors as a result of its high hardness, its uniformity from pellet to pellet, and its toughness and strength. Wheelabrator Steel Abrasive can make a big dent in your total cleaning costs. Write for our Handbook of Blast Cleaning Abrasive Performance, full of vital information to help you control abrasive consumption and cleaning costs.

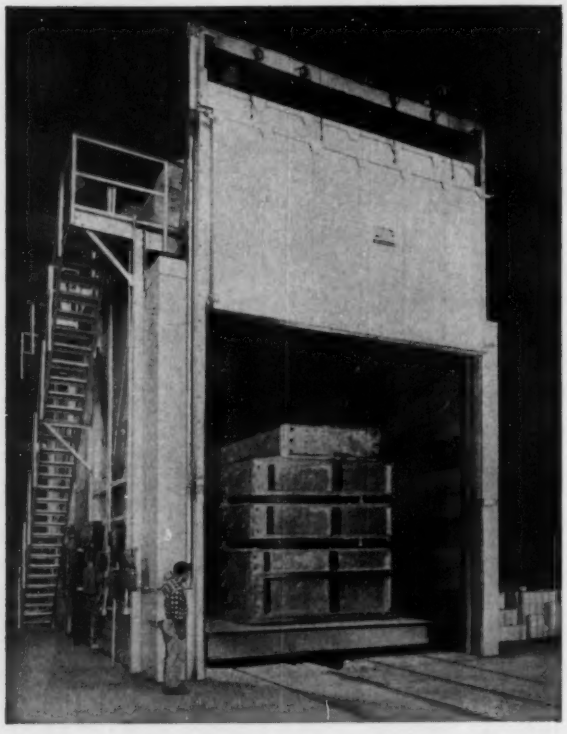
VITAL VALUES FOR INDUSTRY

WHEELABRATOR
STEEL ABRASIVES

WHEELABRATOR CORPORATION, 505 S. Byrkit St., Mishawaka, Indiana,
In Canada, WHEELABRATOR CORP. of Canada, Ltd. P.O. Box 490, Scarborough, Ont.

For More Information Circle 627, Page 39

SURFACE DRY or "BONE" DRY
COLEMAN OVENS

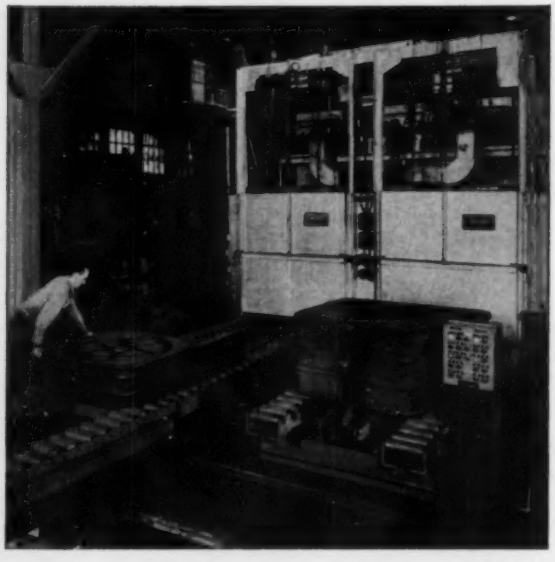


Dry Molds Best!

Below: Two Coleman *JET-ACTION*® High Speed Mold Ovens in a gray iron foundry dry up to 60 molds per day.

Ingenious push button controls enable one operator to index cope and drag molds through the oven on a semi-continuous conveyor system. Ovens are heated by individual *JET-ACTION*® Recirculating Systems.

Coleman *JET-ACTION*® Ovens provide such benefits of dry sand practice as better casting finish—fidelity to pattern—lower cleaning costs with added advantages of reduced handling costs and accelerated flask turnover.



Above: Car-Type Mold Oven in leading steel foundry is one of the largest in the world. Door opening is 16 feet wide x 18 feet high; useful inside work space is 11,000 cubic feet!

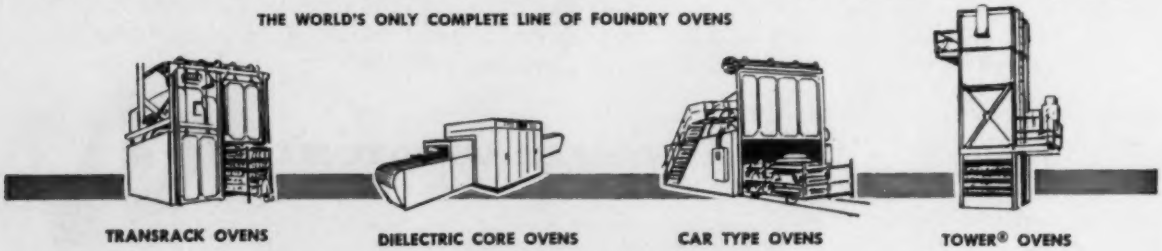
Combination gas and oil fired recirculating air system provides heating capacity to "bone" dry a 300 ton load of molds at temperatures up to 800° F. Heavy duty, sub-floor car moving system and doors at each end of oven are push button controlled.

Write for Bulletin 54.

THE FOUNDRY EQUIPMENT COMPANY • **1821 COLUMBUS ROAD, CLEVELAND 13, OHIO**

World's Oldest and Largest Foundry Oven Specialists — More than half a century of specialized foundry experience.

THE WORLD'S ONLY COMPLETE LINE OF FOUNDRY OVENS



TRANSRACK OVENS | **DIELECTRIC CORE OVENS** | **CAR TYPE OVENS** | **TOWER® OVENS**

LITERATURE for Foundrymen

For More Information, Use Reader Service Card—Page 39

Ceramic Gating Components

Catalog 20 provides information on ceramic gating components such as strainer cores, pouring tubes, ells, and tees.—Universal Clay Products Co., First St., P. O. Box 1631, Sandusky, Ohio.

For More Details Circle No. 409—Page 39

Vacuum Degassing

Bulletin 300 describes vacuum degassing of electric furnace alloy steels in the ladle.—A. Finkl & Sons Co., 2011 Southport Ave., Chicago 14, Ill.

For More Details Circle No. 410—Page 39

Electrolytic Manganese

Eight-page Bulletin 201 discusses use of electrolytic manganese in steel and nonferrous metals. Data provided cover physical and chemical properties, specifications, analyses, color coding guide, and information on packing and shipping.—Foote Mineral Co., 18 W. Chelten Ave., Philadelphia 44, Pa.

For More Details Circle No. 411—Page 39

Green Sand Stabilizer

Leaflet discusses new sand additive used for the elimination of rat-tails, buckles, and scabs in green molding sand practice.—Whitehead Brothers Co., 324 W. 23rd St., New York 11, N. Y.

For More Details Circle No. 412—Page 39

Electric Induction Furnaces

Bulletin 3-FM-1 describes and illustrates new line of 60-cycle electric induction melting and receiving furnaces.—Hevi-Duty Electric Co., 304 Hart St., Watertown, Wis.

For More Details Circle No. 413—Page 39

Material Handling Equipment

Brochure illustrates and describes equipment for specialized material handling, processing, storage, and shipment.—Alfab Co. Inc., Albion, Mich.

For More Details Circle No. 414—Page 39

Air Cylinders

Catalog AH-8 supplies engineering data and price lists for cylinders and boosters.—Lynair Inc., 3100 E. Michigan, Jackson, Mich.

For More Details Circle No. 415—Page 39

Spectrophotometers

Bulletin 735-B discusses series of double-beam, ratio-recording spectrophotometers. It illustrates their application and describes principles of operation.—Beckman Scientific & Process Instruments Div., Beckman Instruments Inc., 2500 Fullerton Rd., Fullerton, Calif.

For More Details Circle No. 416—Page 39

Dust and Fume Control

Air contaminant control system and unit and centrifugal collectors are discussed in Catalog PE-1.—Kirk & Blum Mfg. Co., Cincinnati 9, Ohio.

For More Details Circle No. 417—Page 39

Vibratory Screens

Eight-page bulletin illustrates and describes line of horizontal vibratory screens and conveyors with positive, self-adjusting eccentric drives.—Comco Corp., 5421 Lancaster Ave., Philadelphia 31, Pa.

For More Details Circle No. 418—Page 39

Horizontal Compressors

Bulletin A-74 contains information on horizontal opposed compressors, including specification and performance data.—Joy Mfg. Co., Oliver Bldg., Pittsburgh 22, Pa.

For More Details Circle No. 419—Page 39

Did You Miss These?

Here is a list of popular literature items offered in recent months:

PNEUMATIC SAND SYSTEM—Brady Conveyor Corp., Skokie, Ill. Circle 402, Page 39.

ALUMINUM ALLOY SELECTOR—Wabash Smelting Inc., Wabash, Ind. Circle 403, Page 39.

INDUCTION HEATING and MELTING (Bulletin 1260)—Ajax Magnethermic Corp., Youngstown 1, Ohio. Circle 404, Page 39.

CARBIDE SAWS—Victory Carbide Saw & Tool Co., Antioch, Ill. Circle 405, Page 39.

SONIC DIECASTING—Southern Die Casting & Engineering, High Point, N. C. Circle 406, Page 39.

BARREL FINISHING—Norton Co., Worcester 6, Mass. Circle 407, Page 39.

SHELL MOLD and CORE RESINS—Union Carbide Plastics Co., New York 17, N. Y. Circle 408, Page 39.

Self-Sealing Couplings

Bulletin 629 illustrates and describes self-sealing couplings for fluid piping systems.—Aeroquip Corp., Jackson, Mich.

For More Details Circle No. 420—Page 39

Buckets and Grapples

Bulletin No. 2L-60 describes clamshell buckets, grabs and grapples, and shows relationship of buckets available to weights of materials and sizes of cranes.—Erie Strayer Co., Rudolph Ave., Erie, Pa.

For More Details Circle No. 421—Page 39

Flask Upsets

Catalog No. 208 illustrates and describes the various types of upsets available for increasing the height and amplifying the strength of the company's flasks. Specifications and prices are included.—Hines Flask Co., 3431 W. 140th St., Cleveland 11, Ohio.

Refractory Maintenance

Reprint discusses refractory maintenance in basic oxygen furnaces, including recommended refractory brick and ramming mixture for each section of the furnace.—Harbison-Walker Refractories Co., Pittsburgh 22, Pa.

For More Details Circle No. 423—Page 39

Lift Truck

Specification sheets describe lift trucks with foot-operated floor lock brakes.—Port-A-Lift Co., 3680 E. Schumann Rd., Bay City, Mich.

For More Details Circle No. 424—Page 39

Gas-Fired Heaters

Bulletin GA-61 describes and illustrates gas-fired duct heater assemblies, giving advantages, unit outlines, dimensions, capacities, and mounting instructions.—L. J. Wing Mfg. Co., Linden, N. J.

For More Details Circle No. 425—Page 39

Plant Safety Marking

Booklet called "Colors and Methods" discusses safety marking colors and their applications.—Industrial Maintenance Div., Sherwin-Williams Co., Cleveland 1, Ohio.

For More Details Circle No. 426—Page 39

Ball Casting Machine

Twelve-page bulletin describes the Payne process and equipment for the automatic and continuous production of alloy steel and chilled iron grinding balls.

The Keokuk Family, with your good in mind,
Makes many, many tests;
For Kemco must not ever fail
To be the very best.

When you think of SILICON . . . think of KEMCO!

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The superior form of silicon introduction . . . available in 60 and 30 lb. pigs and 12½ lb. piglets . . . In regular analysis or alloyed with other elements. For uniform high purity, aluminum producers specify Kemco Silicon Metal.

The machine's rotary turntable has 36 water-cooled copper ball molds and produces 6000 to 10,000 lb of balls per hour. —Stearns-Rogers Mfg. Co., Denver, Colo.

For More Details Circle No. 427—Page 39

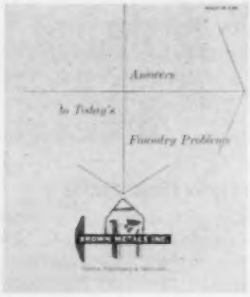
Water-Cooled Welding

Information on the use, advantages, and problems of liquid cooling methods in welding processes are featured in the pamphlet "Use of Water Cooling for Welding Equipment." — Bernard Welding Equipment Co., 10232 Ave. N, Chicago 17, Ill.

For More Details Circle No. 428—Page 39

Engineering Service

"Answers to Today's Foundry Problems" is a folder which outlines company's



functions and services.—Brown Metals Div., Brown Fintube Co., 300 Huron St., Elyria, Ohio.

For More Details Circle No. 429—Page 39

Crane Specifications

Service and speed classifications of all types of industrial cranes are listed in the Crane Specification Tablet. Information on girders, trucks, electrical systems, brakes, and other components are provided.—Conco Engineering Works Inc., Mendota, Ill.

For More Details Circle No. 430—Page 39

Foundry Refractories

Brochure tells of cupola and ladle refractory materials for use in ferrous and nonferrous foundry operations. — North State Pyrophyllite Co. Inc., Pomona, N. C.

For More Details Circle No. 431—Page 39

Carbon Sand

Booklet on properties and applications of carbon sand provides data on mold facing and core mixtures.—Humble Oil & Refining Co., P. O. Box 67, River Rouge Station, Detroit 18, Mich.

For More Details Circle No. 432—Page 39

Air Scrubber

Brochure discusses air scrubber and diagrams 4-stage process in wet dust collection.—Antipol Corp., 407 Hill Arcade Galesburg, Ill.

For More Details Circle No. 433—Page 39

Cutting-Off Wheels

Folder No. 222-16 discusses and shows line of cutting-off wheels. Specifications

Crouse-Hinds reports on Shalco Shell Core Blowing:

3 Shalcos Plus 1 Operator Produce 7,000 Cores In 7½ Hours!

Production as high as 7,000 top quality cores in one 7½ hour shift is the big reason Crouse-Hinds Co. of Syracuse, N.Y., is sold on Shalco Shell Core Blowing. C. H. Alvord, New Process Engineer, explains: "We decided to try shell cores because we need extremely smooth surfaces on the inside of our electrical fittings and are always looking for ways to reduce production costs. After an extensive study of *all* shell core machines, we bought a Shalco U-180 and, because of its excellent performance, soon installed three more identical machines. With our present arrangement, three of the Shalcos are operated by one man while the fourth is being set up for the next job. With the Shalcos we can produce a wide variety of cores including those shown at right; sometimes need *three* inspectors to handle and pack production output of the *one* core machine operator!"

Efficiencies such as those described by Mr. Alvord are commonplace among Shalco users. It will pay *you* to get complete information. Call, write or wire . . . today.

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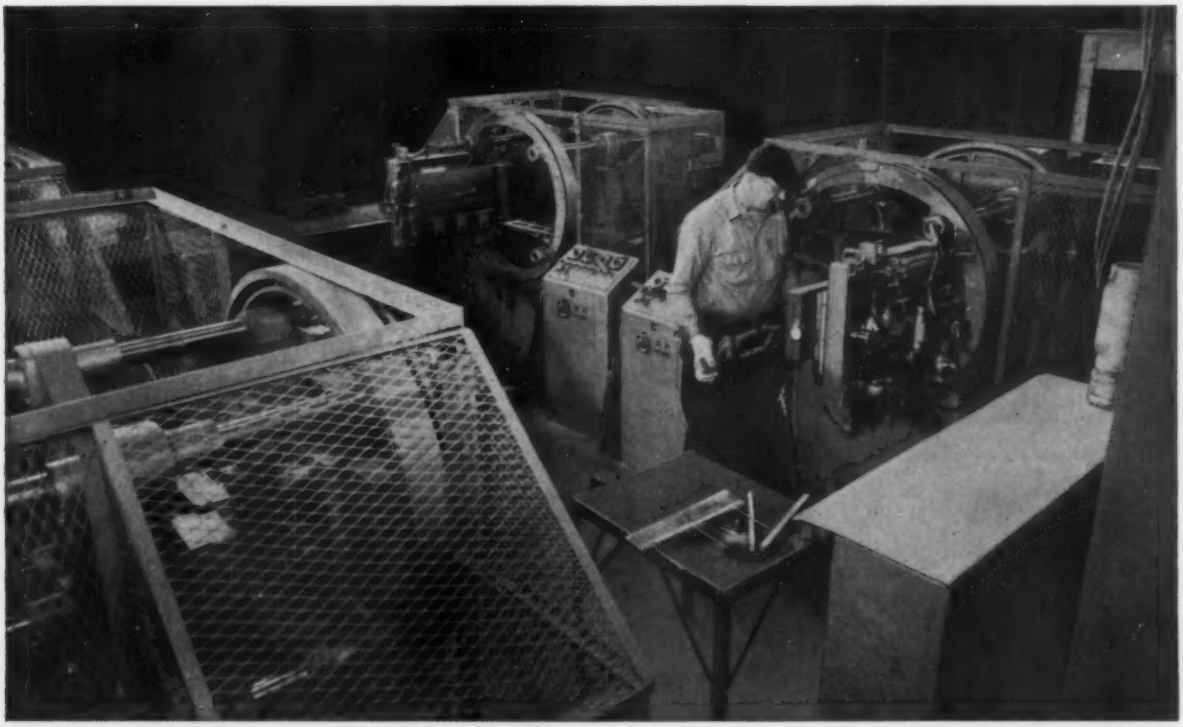

BOOKS
FOR FOUNDRYMEN

Our Book Department carries a wide variety of books of particular interest to foundrymen. Here are some titles presently available. If you are seeking a title not listed, write us—we'll be glad to get it for you.

PRINCIPLES OF METAL CASTING
By Richard Heine and Philip Rosenthal. Covers every step of standard foundry processes . . . explains what equipment is used for each phase, when and how it is used . . . and describes proven procedures that make for greater economy in metal casting. Crammed with photographs and illustrations. —$7.75

STEEL FOUNDRY PRACTICE
By John Howe Hall. A comprehensive sourcebook covering all phases of modern steel foundry practice. Contains practical information on almost every production problem steel foundrymen encounter. —$12.00

A NEW COST MANUAL FOR THE GRAY IRON CASTINGS INDUSTRY (No. 2)
Here in 120 carefully planned pages is a complete Cost Account System for both a small foundry with minimum accounting facilities and a large foundry capable of detailed cost determinations for accuracy and completeness.
Two cost manuals under one cover —Cost Manual No. 1, representing twenty years of editing and revising by practical operating experts is included as a supplement. —$10.00

CAST METALS HANDBOOK, 4TH EDITION
Every modern thinking product designer needs this handbook. Contains reliable working data for utilizing the properties of cast metals to the greatest engineering advantages—unbiased and substantiated information on new, reliable developments in cast materials—practical, up-to-date facts on HOW to get the most out of castings designs. —$12.00

BRASS AND BRONZE FOUNDRY PRACTICE
By Harry M. St. John
Now brass founders have available a comprehensive modern treatment of all aspects of brass foundry theory and practice in one source.
It covers the entire range of brass foundry operations and its 23 chapters discuss alloys, technical and operating procedure, quality control, testing, brass foundry economics, cost control, casting design, patternmaking, foundry layout, and salvage of waste material. The text is supplemented by 85 illustrations which clarify and enlarge on the subject matter.
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THE CUPOLA AND ITS OPERATION
Latest developments, such as hot blast, basic lining for nodular iron, and emission control are covered. Chapters such as those on refractories, principles of combustion, and metallurgy have been greatly augmented or are presented for the first time. More than 50 of the country's outstanding foundrymen have contributed their knowledge and experience to this book. —$11.00

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A comprehensive and up-to-date 526-page handbook. This work reflects the knowledge of the malleable industry's foremost foundry technicians and casting designers. New emphasis has been given to the description of pearlitic-malleable iron. —$10.00

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This English edition has been prepared by the British Steel Castings Research Association. An up-to-date study of the problems of castings design and is well illustrated by 121 working diagrams. —$3.00

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By Harry C. Rippel. Contains the latest and experimental information on bronze bearing design. Published by Cast Bronze Bearing Institute, Inc. —$2.00

BASIC COST PRINCIPLES FOR NONFERROUS FOUNDRIES
An up-to-the-minute guide for costing in both small and large foundries. Prepared by practical foundrymen, book is based on 10 years' research and experience under Government pricing regulations. —$5.00

CHART OF ACCOUNTS AND COST DICTIONARY
Supplement No. 1 to BASIC COST PRINCIPLES FOR NON-FERROUS FOUNDRIES
CHART OF ACCOUNTS for all general ledger accounts including those recommended for foundries using the Expanded Cost System. COST DICTIONARY to guide office personnel in distributing items of expense to proper department and classification in Simplified Cost System and Expanded Cost System. —$2.00

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- ☐ Cast Metals Handbook, 4th Edition
- ☐ Cupola and Its Operation
- ☐ Malleable Iron Castings (1960)
- ☐ Practical Guide to the Design of Steel Castings
- ☐ Cast Bronze Bearing Design Manual
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Models include magnetic drums and controlled-feed, packaged drum separators complete with housing and motor drive . . . standard and heavy duty constructions . . . with high intensity ERIUM®-Powered magnetic circuits for greatest separation efficiency.

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Keeping step with the growth of American and world-wide industry, Eriez continues to improve and expand its magnetic separation equipment to meet the challenges of new processes and increased production volumes.

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A GROWTH COMPANY . . .
10 NEW PRODUCTS IN THE LAST 5 YEARS

cover both plain and reinforced wheels.—Peninsular Grinding Wheel Co., 729 Meldrum Ave., Detroit 7, Mich.

For More Details Circle No. 434—Page 39

Power Tools

Catalog 10-0 illustrates and describes power tools, including impact wrenches, drills, metal finishing tools, etc.—Master Power Corp., 6225 Cochran Rd., Solon 39, Ohio.

For More Details Circle No. 435—Page 39

Screen Tensioners

Data Sheet 26B9995 discusses tensioners for cloth and plate deck screens. It also illustrates necessary components and gives installation instructions. — Allis-Chalmers Mfg. Co., Milwaukee 1, Wis.

For More Details Circle No. 436—Page 39

Trolley Conveyors

Book 2730 contains information on trolley conveyors. It gives tables of materials, dimensions, specifications of components, and photographs and layout drawings of installations.—Link-Belt Co., Dept. PR, Prudential Plaza, Chicago 1, Ill.

For More Details Circle No. 437—Page 39

Inert Atmosphere Generators

Bulletin 710 illustrates and describes inert atmosphere generators. Engineering specifications and application data are included.—Lindberg Engineering Co., 2450 W. Hubbard St., Chicago 12, Ill.

For More Details Circle No. 438—Page 39

Dust Control Systems

Dust control systems and their basic essentials are discussed in 20-page bulletin 922A. Typical installations are illustrated. —Pangborn Corp., Hagerstown, Md.

For More Details Circle No. 439—Page 39

Wire Rope Slings

Bulletin 401 illustrates and describes wire rope slings and swaged assemblies and lists rated capacities, sizes, and body diameters.—Brown & Perkins Inc., 675 New Brunswick Ave., Perth Amboy, N. J.

For More Details Circle No. 440—Page 39

Material Handling Equipment

Condensed catalog SP 4070 discusses line of fork trucks, powered hand trucks, and similar equipment. Divided up by

ERIEZ Magnetic Minute

60 seconds that will help you improve operating efficiency.

CLOGGED BINS A PROBLEM?

If troublesome slowdowns caused by sticking, arching, stubborn materials are your problem, here's good news:

Eriez Hi-Vi® electro-permanent magnetic Unit (Bin) Vibrators are your answer. They've proven superior time and again for dependable movement of stubborn masses of granular, lumpy or powdered materials in bins or hoppers.

Their concentrated vibration is directed to deliver maximum efficiency precisely where it is needed. The full Hi-Vi line offers models for use with all sizes of bins with wall thickness to ½" — Special models are available for hazardous, dusty locations.

All models bring you these advantages.

- Direct AC operation — no need for rectifiers.
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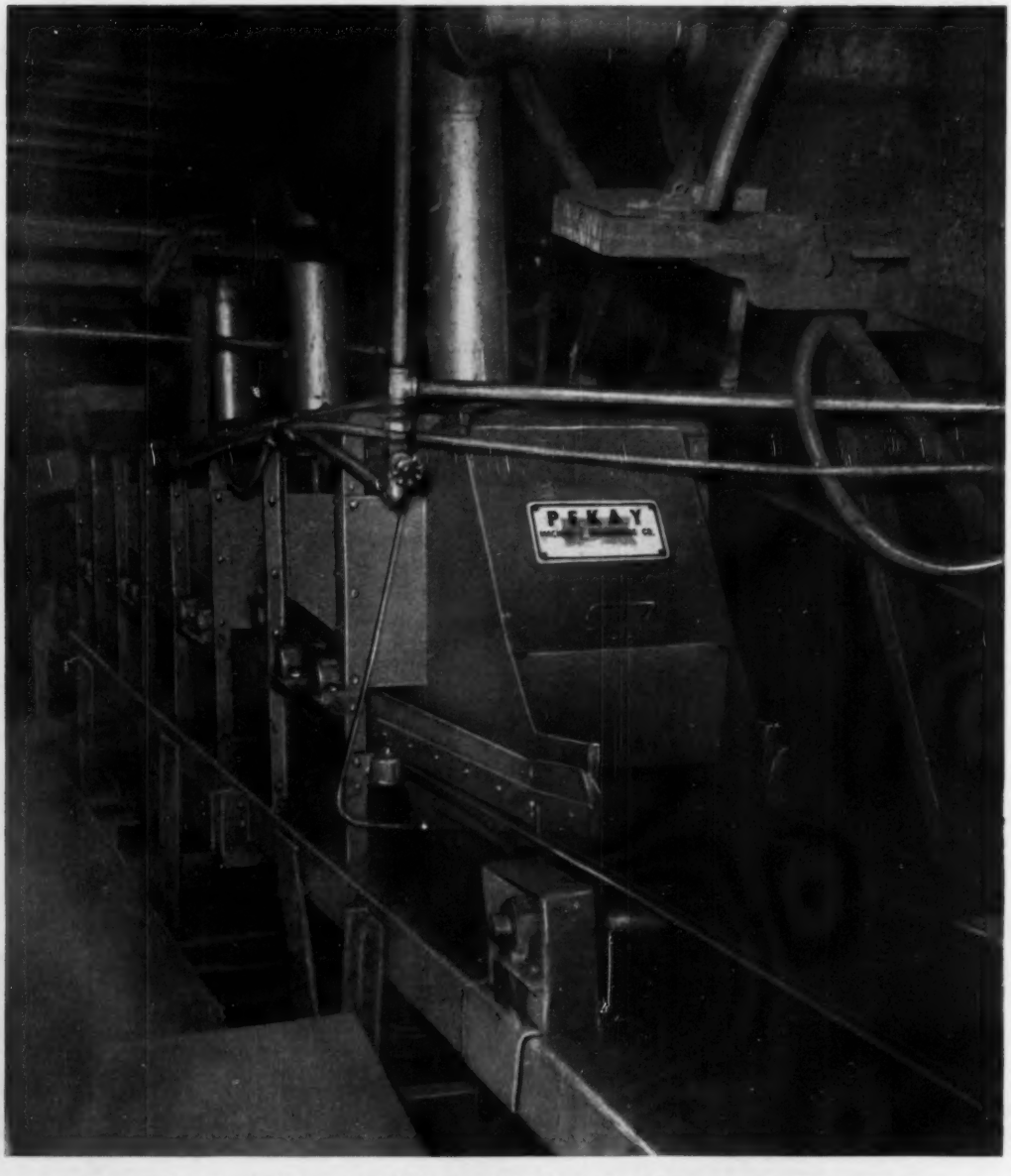
CONTINUOUS SAND

No Floor Space



Typical Pekay Mixer-Muller on inclined belt. It has a capacity of as much as 120 tons per hour.

CONDITIONING

Required!

COOLING
MIXING-MULLING
AERATING...

COOLING

Effective cooling with a Pekay Coolerator is accomplished in tonnages from 5 to 160 TPH. Sand can be stored cooled. The cooling of sand before mixing or mulling (and not while mixing and mulling) prevents the mulling unit from being compromised for a cooling operation.

MIXING and MULLING

Mixing and mulling in the Pekay Mixer-Muller is accomplished by repetitive mulling, cutting and mixing of sand in small increments on your conveyor belt. Mulling is done against rubber. The complete mixing and mulling operation is done continuously without footings and foundations for the equipment. Can also be used in conjunction with your existing mullers to increase sand capacity and quality.

AERATING

All mulling cakes are broken up and all sand is thoroughly fluffed by the Pekay Airator. This insures high permeability, even mold hardness, and reduction in defective castings.

Pekay Sand Conditioning Equipment cools, mixes, mulls and aerates in one continuous, uninterrupted operation. And by cooling sand where it should be cooled—*before* mulling, Pekay conditions all sand thoroughly. No valuable mulling time is wasted in cooling . . . you get the full benefit of a complete mulling cycle . . . rated mulling capacity is *delivered* capacity.

Continuous conditioning is *not* a new idea. It has been an accomplished, precisely engineered fact with Pekay equipment for nearly a decade. Dozens of installations*—in foundries of all sizes and types—are operating now in this country and abroad, and have been for years.

Yet for all their efficiency, Pekay Mixer-Mullers, Coolerators and Airators require *no* floor space, *no* expensive footings or foundations, *no* change in your present production facilities. All Pekay equipment is installed on your existing conveyors—in most cases over a single weekend. Downtime is practically eliminated . . . production is uninterrupted . . . waste of productive man-hours is minimized. The cost: only one-third as much as conventional equipment with the same rated capacity.

Pekay equipment can also be used in conjunction with your present facilities to increase your sand capacity by as much as 85%.

If you are interested in obtaining the benefits of truly continuous sand conditioning, fill in and mail the coupon or contact Pekay direct.

**List on request.*

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Pioneers and developers of continuous sand conditioning equipment for foundries. Used internationally.

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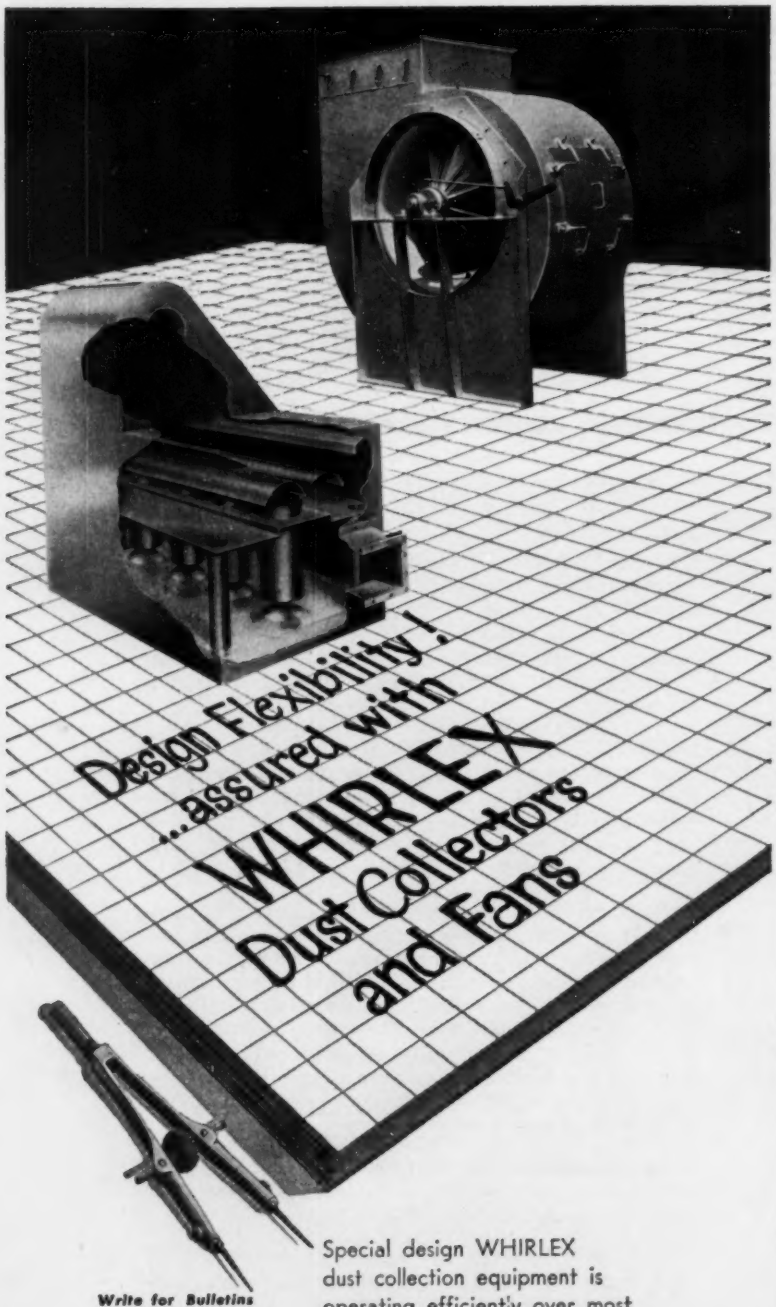
I would like information on:

- ☐ Pekay Mixer Mullers
- ☐ Pekay M-T-Matic Buckets
- ☐ Pekay Coolerator
- ☐ Pekay Airators



Write for Bulletins FD-11 & WC-100

Special design WHIRLEX dust collection equipment is operating efficiently over most of the world. Special designs for special applications are a specialty with WHIRLEX!

FLY ASH ARRESTOR CORPORATION
205 North 1st Street / Birmingham, Alabama
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Bag Collectors — Mechanical Collectors — Wet Collectors
Induced Draft Fans — Forced Draft Fans — Exhaust Fans
Self Supporting Stacks — Duct Work

product lines, each section contains product information and an action photograph.—Industrial Truck Div., Clark Equipment Co., Battle Creek, Mich.

For More Details Circle No. 441—Page 39

Gas Regulators

Catalog 806 illustrates and describes industrial gas regulators and accessory equipment. It also includes a reference chart giving ranges and sizes of models available.—Air Reduction Sales Co., div. of Air Reduction Co., 105 E. 42nd St., New York 17, N. Y

For More Details Circle No. 442—Page 39

Aluminum Casting Alloy

Bulletin describes Precedent 71, new aluminum casting alloy available in two

grades. Property and application data are included.—William J. Jobbins Inc., Aurora, Ill.

For More Details Circle No. 443—Page 39

Blast Cleaning Machines

Illustrated catalog features batch-type airless abrasive blast cleaning machines. Construction and operating information is included.—Wheelabrator Corp., 1102 S. Byrkit St., Mishawaka, Ind.

For More Details Circle No. 444—Page 39

Engineering Service

Brochure describes free engineering services to help cut costs of industrial truck users. Examples show production problems, solutions, and photos of machines in action.—Elwell-Parker Electric Co., 4205 St. Clair Ave., Cleveland 3, Ohio.

For More Details Circle No. 445—Page 39

Air Valves

Four-page bulletin illustrates and describes high-speed, pilot-operated air valves. A companion line of bottom and side ported bases also is described.—Hannifin Co., Dept. 238, 501 S. Wolf Rd. Des Plaines, Ill.

For More Details Circle No. 446—Page 39

Fan Equipment

Mid-draft inducers, cyclone roof fans and centrifugal blowers are described in bulletins 234, 226, and 236, respectively. Specifications, data, and formulas are given for each unit.—Stamford Fan Co. Inc., 4 South St., Stamford, Conn.

For More Details Circle No. 447—Page 39

3M Abrasives Boost Aluminum Grinding Output 50%

Cast aluminum transformer heads are manufactured here at National Aluminum's Peoria, Illinois, plant. Gates, risers, flashings and parting lines must be ground off prior to assembly. The abrasive belts in use—a standard glue-bonded type—were proving unsatisfactory: low production volume, excessive down time were keeping costs high.

After analysis of the operation, the 3M Representative suggested the use of tough, resin-construction "Three-M-ite" Resinbond belts, with a specific belt lubricant.

Now this difficult grinding job is done faster and better. National Aluminum reports a 50% increase in the number of units ground and a corresponding decrease in abrasive costs!

Why not let 3M's new COST CHECK 5-4-5 Program help you to effectively investigate ways to lower costs and increase production. Discover:

- If your grinding can be done more economically
- If your finishing is as efficient as possible
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Send today for a free COST CHECK 5-4-5 Review Form *without obligation*. Put 3M's years of abrasive know-how at your disposal.

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WHAT'S COOKING AT ERIE?

PLENTY! Brand new coal mixing bins, a new screening plant, and new loading stations have just been completed at Interlake Iron's Erie Coke Plant.

These new facilities guarantee you a vastly improved foundry coke.

A NEW AND BETTER FOUNDRY COKE

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FERROALLOYS • LAKE FUELING • LAKE SHIPPING

For More Information Circle 637, Page 39

Six-cylinder aluminum engine block is shown just after the die has been opened

Diecast Block Production

Is Highly Mechanized

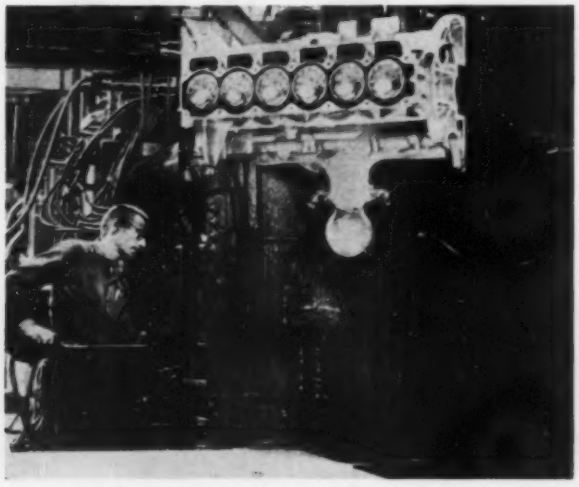
By ROBERT H. HERRMANN
Associate Editor

● CHRYSLER Corp.'s production plans for the 1962 model year include 60,000 six-cylinder, diecast aluminum blocks for 225 cu in. displacement engines available as optional equipment in Valiants and Lancers. The block was described previously in the April issue of FOUNDRY, pp. 62-64.

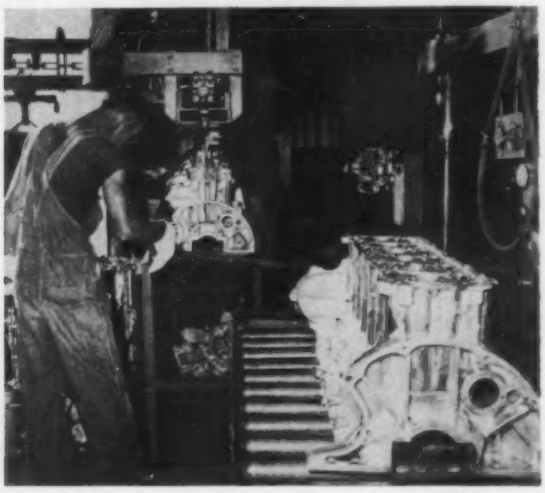
The blocks are cast in two, 2000-ton diecasting machines on a highly mechanized production line housed in a recent 18,000-sq-ft addition to the Chrysler Casting Plant, Kokomo, Ind. Five other 2000-ton machines incorporated on the line provide additional capacity for blocks and other large parts diecast at the plant.

Almost all transportation and storage of blocks and iron cylinder

As-cast block, removed from machine in background, is being lowered to table for spruing

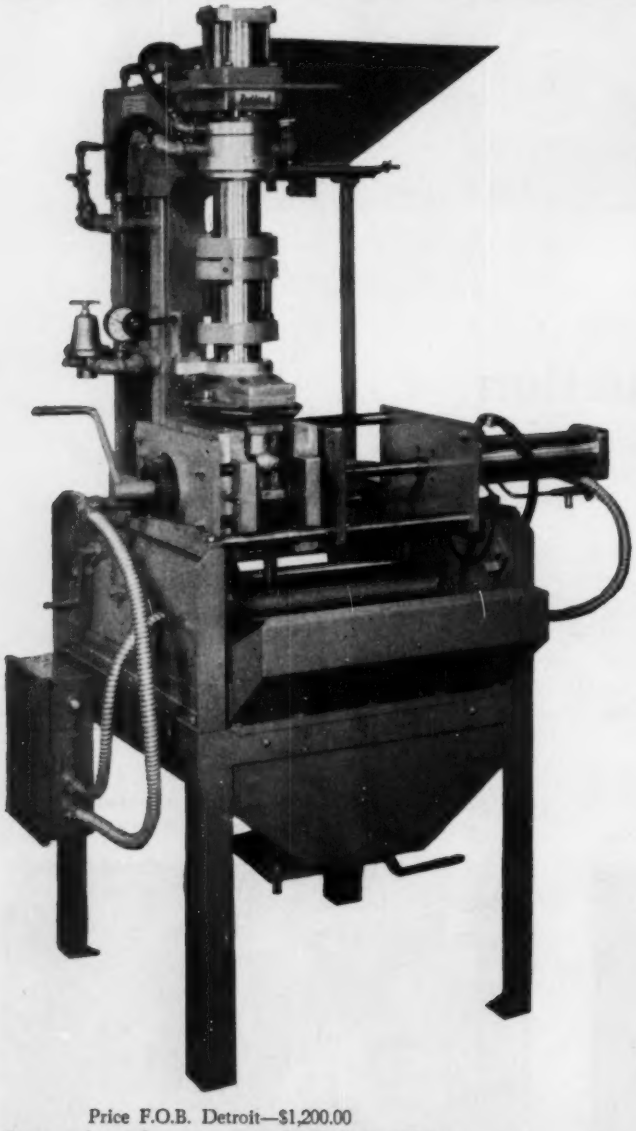


Blocks, pulled off the cooling conveyor, are moved into press at right for trimming



Redford

MODEL HP-4
SHELL CORE BLOWER



A very fast low cost machine that is setting new standards in the production of small shell cores. The quality of intricate shell cores is improved because sand is blown into core box cavities through unrestricted blow holes. A novel cradle-type core box clamp is used to invert the core box and at the same time bring the core box within easy reach of the operator for core removal. There is no out of balance weight to struggle with. The machine can handle core boxes up to 10" x 10" in size. Shell cores may weigh up to 4 lbs., before draining.

The HP-4 Redford has ample blow capacity and can also be used to blow Furfural resin sand mixes into heated core boxes.

Price F.O.B. Detroit—$1,200.00
For complete information write for Bulletin HP-4

. . Above cores illustrate the variety of work that can be done with the Redford HP-4 Core Blower.

REDFORD IRON & EQUIPMENT CO.
20733 Glendale - Detroit 23, Mich.
Phone: KEnwood 1-8611

liners and delivery of molten aluminum is done on overhead conveyors at or near ceiling level. Floor-mounted gravity roller conveyors, however, are used to transport blocks from the trim press to blast cleaning, inspection, and testing processes.

Monorail hot metal carriers bring molten aluminum to the diecasting machines from any of four, 20,000-lb-capacity holding furnaces. SAE 303 alloy is used. It contains approximately 84 per cent aluminum, 11 per cent silicon, 3.5 per cent copper, and minor amounts of magnesium, iron, zinc, nickel, and other constituents.

Automatic Conveyor System — Centrifugally-cast gray iron liners are brought to the diecasting machines, six at a time, on special carriers of a combination powered-free rolling chain conveyor system. Each carrier is suspended from a separate dolly moved along a monorail by the chain conveyor. The dolly automatically is disengaged from the chain conveyor at a diecasting machine or is bypassed, depending on the number of dollies already on the spur monorail section at the machine.

Disengaged dollies roll by gravity to a wait station. At the proper moment in the machine cycle they roll to a device which lowers them and deposits the liners on slides. An air ram pushes the liners horizontally to a wait station on an air-powered lift. At the proper time, it raises the liners to another air-powered ram which pushes them to six induction coils in an oven.

The liners are heated to 780° F in 90 seconds then are passed from the induction coils to a hydraulic delivery device which moves the liners into the open die and sets them on six holding mandrels. Fourteen seconds elapse from the time the liners leave the oven until the mold is closed and the aluminum injected. During that time the liners lose less than 150° F. Consequently they are above the 600° F temperature considered desirable to minimize residual tensile stresses set up in the aluminum by differential contraction of the two metals.

Inject 69 lb of Aluminum— Molten aluminum is injected into the 22-ton, H-13 steel die at a pressure estimated at 12,000 psi. The shot of aluminum weighs 68.98 lb. The cast-in liners weigh 23.62 lb to make the total weight of the poured block 92.6 lb. The block weighs 76.7 lb as shipped from the foundry and 64 lb after final machining.

About 22 blocks are cast each hour on each machine, making the production cycle approximately 2 minutes, 43 seconds. The blocks are cast horizontally and are ejected from the open die to the holder on a hydraulic device which lifts the casting out of the die, turns it, and lowers it to a table where the machine operator inspects the casting visually and knocks off gating metal, tossing it into a box.

He pushes the block to the carrier of a dolly which previously brought liners to the machine. The dolly is raised automatically and pushed by air cylinder back to the monorail chain conveyor for movement to the storage section of the monorail. Provision is made to store each block for a minimum of

One name for all FOUR!

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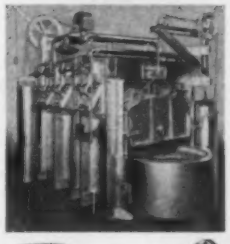

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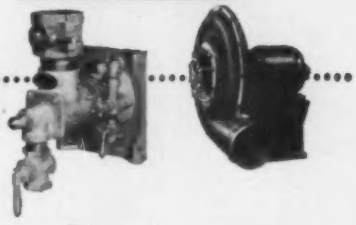
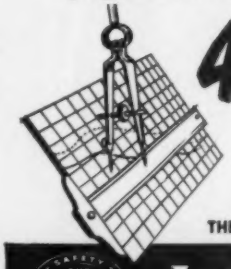


3. ENGINEERING SERVICE

Your new furnace of any size can be engineered by JOHNSTON and built under JOHNSTON supervision with labor and materials furnished by you if you prefer.

Illustrated at right is a standard car type furnace used for annealing and normalizing. It may be either direct fired or incorporate the JOHNSTON JET RECIRCULATING (JR) system, and can have fully automatic program control for temperature ranges from 1250° to 2150° F.



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You may not need a new furnace. JOHNSTON re-engineers, re-builds to present day standards, with our labor or yours, at our plant or yours, including jet re-circulating systems, and to meet air corps and other government certification.

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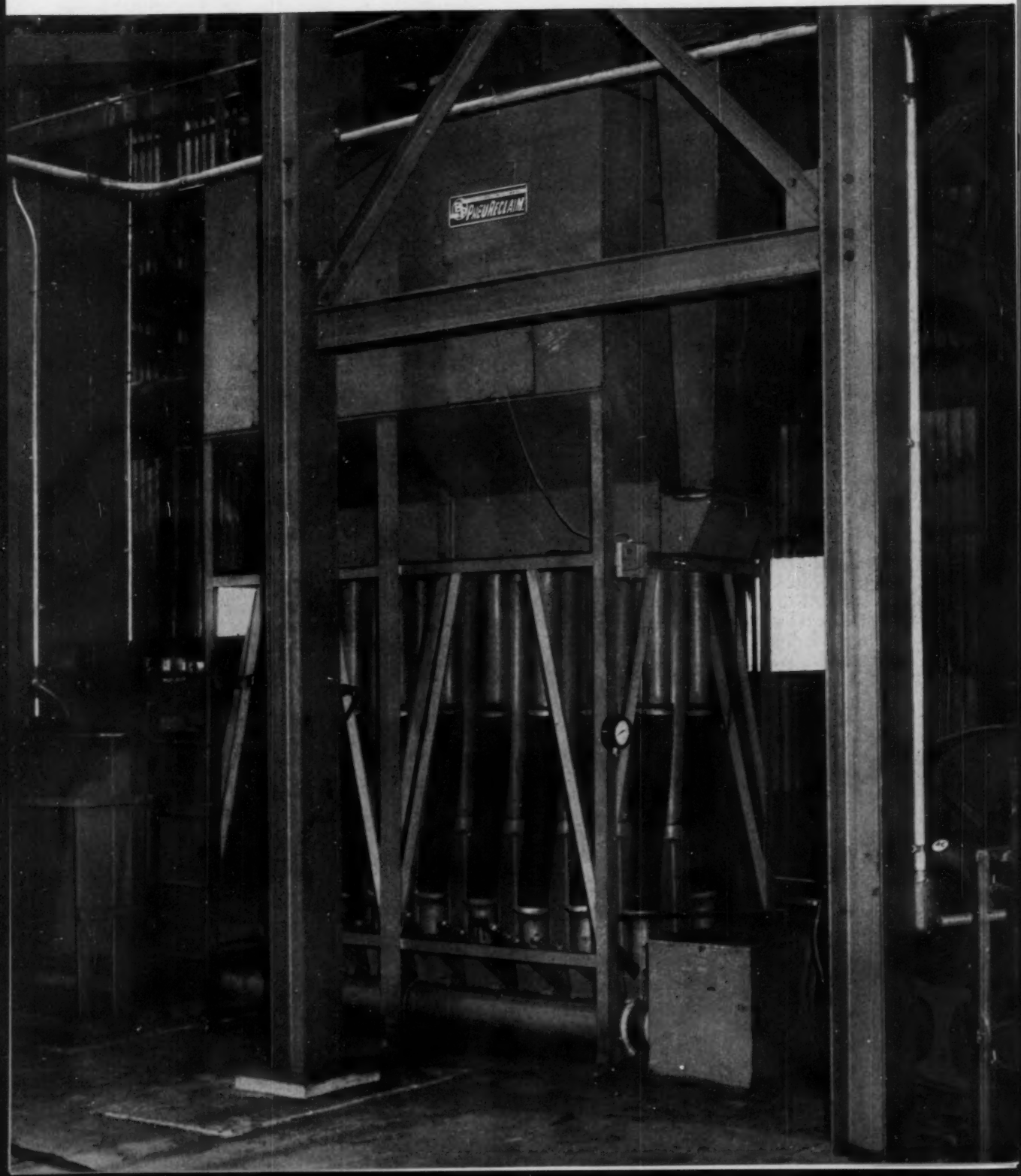
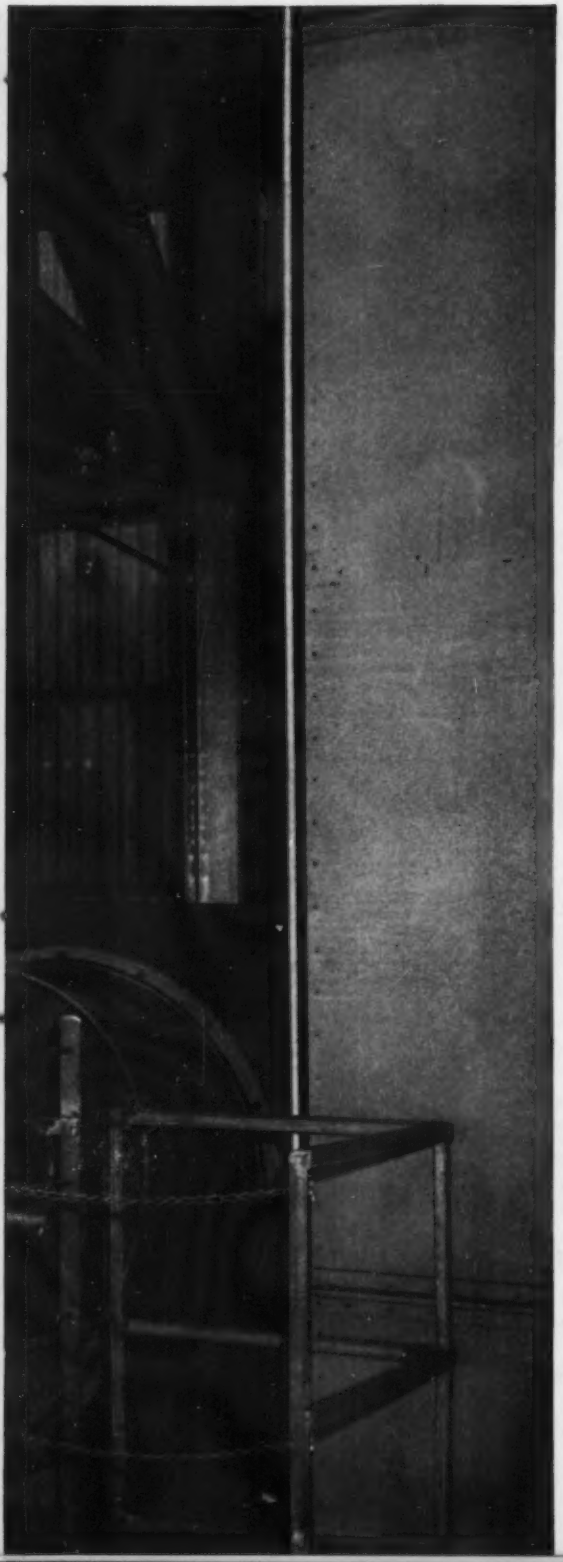


It's Output That Counts

GREATER SCRUBBING CAPACITY



From B & P RESEARCH

In Comparative Testing, PNEU-RECLAIM Has Been Proved To Have Up To 50% Greater Scrubbing Capacity Than Like-Size, Like-Purpose Machines.

Only when research and development are combined with practical testing and proving can breakthroughs in production efficiency be attained. In continuing work at the Beardsley & Piper Technical Center, B & P engineers have achieved just such a breakthrough. Pneu-Reclaim, the world's leading sand reclamation unit, has undergone design changes which have resulted in even further simplification of operation. But most important of all, these design changes have increased Pneu-Reclaim efficiency to where output capacities (based on the same percentage of clay removal) are now 50% greater than ever before . . . and certainly far greater than any other comparable unit in today's market.

These capacity figures are not just research estimates. They have been substantiated by repeated reclamation of representative sands from numerous leading foundries throughout the country—and B & P stands ready to further verify these results by processing a representative amount of your sand and returning it to your foundry for shop tests in cores and molds —you can be confident of B & P foundry proved performance.

Lower Initial Cost

Pneu-Reclaim's increased output can mean lower initial cost for your sand reclamation system. If you have had a previous reclamation survey indicating a certain sized reclamation unit is required, the newly designed, higher capacity Pneu-Reclaim may allow you to enjoy the cost-cutting advantages of sand reclamation with a smaller unit. Call in your Beardsley and Piper sales representative and have him recheck your needs as dictated by the new, higher capacity Pneu-Reclaim. His short visit can mean greater savings for your foundry operation.

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FEMA

For More Information Circle 640, Page 39

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Model DHL

Model CB

Faster hardness testing is yours when you use a Detroit long-stroke testing machine. The long-stroke test ram does the adjusting to various work piece heights, and does it fast. Constant height table always matches conveyor height, too. Hydraulically operated, with or without direct reading dial (shown with). Larger and special machines made to order.

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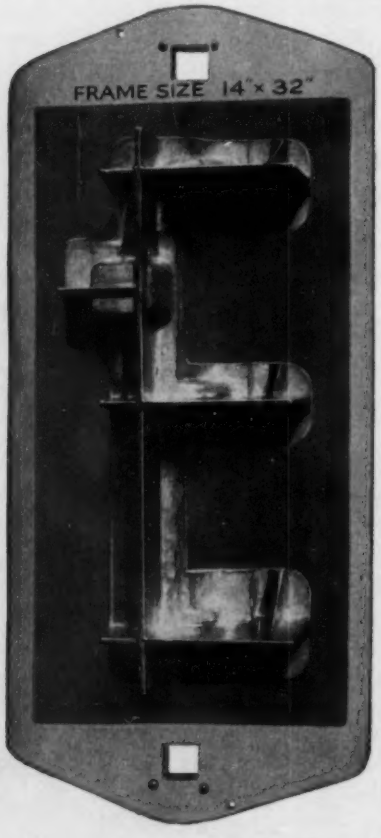

Let's talk profits!
Let's talk increased production!
Let's talk about . . .

TAMASTONE

PATTERN COMPOUND

The Drier pattern at left is for air intake diesel manifold made from an original master pattern. *Only one skrinkage!* Material is aluminum. Pattern was used for 50 Driers. Only 3 hours labor and 35 pounds of TAMASTONE were required. Up to 1,000 castings have been made from a plate of this type!

No special skill needed to increase production 400% or more! . . . WRITE . . .

TAMMS INDUSTRIES CO.

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54 minutes so that all are the same temperature (room temperature) before entering the trim press. That permits more accurate and consistent trimming.

The cooling conveyor is free of the constant power chain drive. The dollies are moved along the monorail intermittently by an air ram. The monorail dips at the trim press to bring the individual carriers, each with a block, to floor level. As a dolly comes into position at the end of a short roller conveyor, an air shuttle arm with a pusher dog pushes a block off its carrier to the roller conveyor.

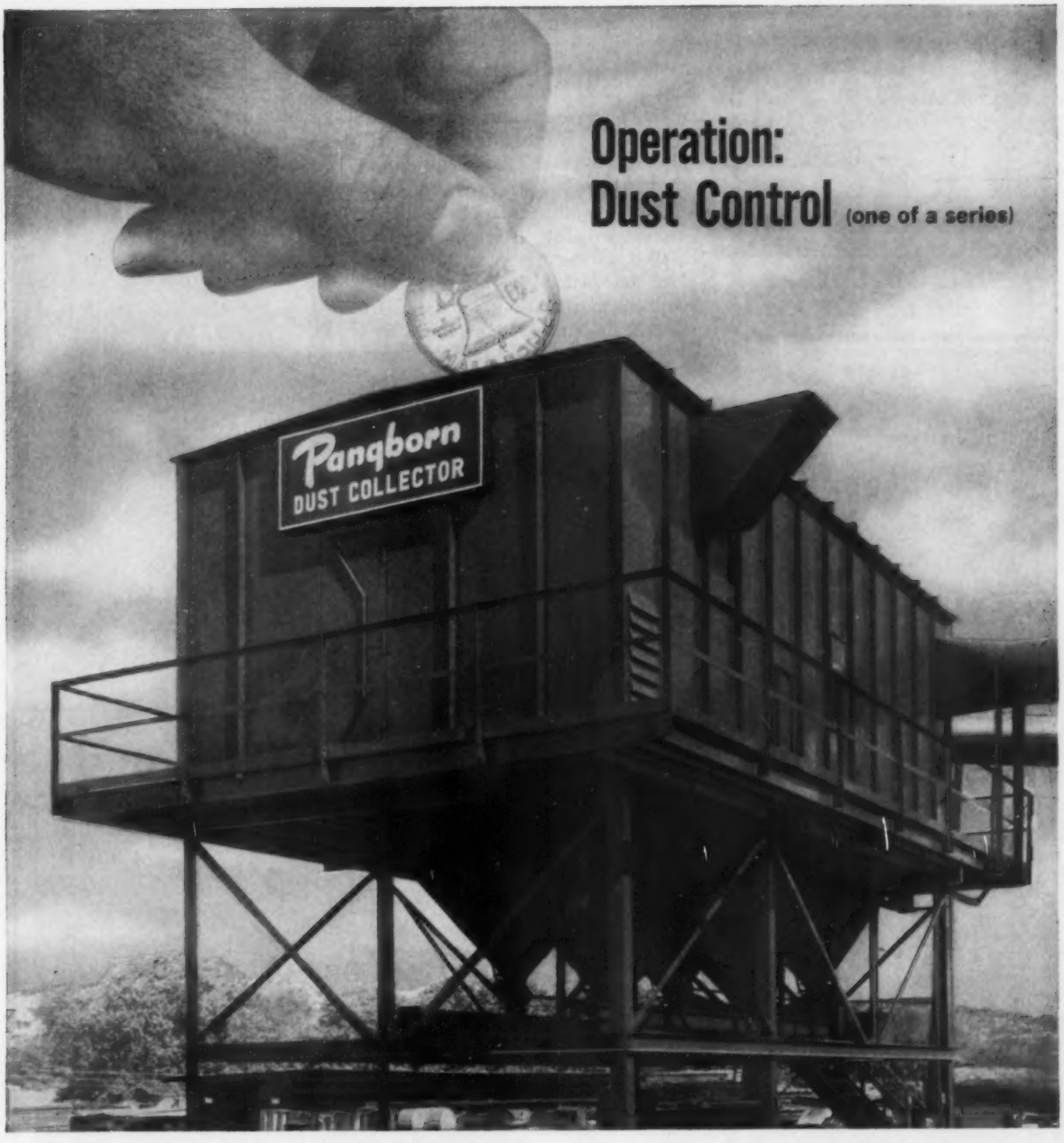
Inspect Castings—The trim press operator inspects the casting and pushes it from the conveyor to the press for trimming. A second man pulls the trimmed block from the press and hooks it on a monorail conveyor for movement through a shot blast room. The blocks are peened with aluminum shot.

Shot-blasted blocks are unloaded to a roller conveyor where the iron liners are sprayed with fluorescent material. Blocks are pushed into a booth for inspection under black light. As they leave the booth they enter a two-station differential air pressure testing machine.

The oil gallery and the water jacket are tested at a pressure of 17 psi. Good castings, of course, are passed for shipment. Those that show an unacceptable level of leakage are dunk-tested to determine the nature of the leak. Blocks that can be impregnated for satis-

"I see the boss still is trying to land that Government contract"

For More Information Circle 642, Page 39



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Yet salvage opportunities are only a part of the savings offered you by Pangborn Dust Control equipment. It also eliminates health hazards in your plant and makes for better housekeeping; it removes abrasive or corrosive dusts that can endanger machinery; and it increases the efficiency of your employees and improves community relations.

Pangborn has the right Dust Control equipment for all your needs: Dry Collectors in Cloth Bag, Tube, Screen, Self-Cleaning, Unit Types and Wet Collectors in all sizes. For all the facts write:

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For More Information Circle 643, Page 39

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Desmond Hex Dresser

LIVES FOR FOUNDRY GRINDING WHEEL

Desmond Heavy Duty Dresser

DRESSERS

Cut grinding and snagging costs with inexpensive Desmond Hex dressers. They bring grinding wheel faces to "new" efficiency by removing loaded metal and exposing sharp abrasive grains. And Hex dressers provide six sets of bearings in one set of bearing blocks . . . for extra life on average wheels. For resinoid and rubber bonded high-speed wheels use the ball-bearing Desmond Heavy Duty Dresser. Ask your Desmond distributor's advice.

Desmond

Desmond-Stephan Mfg. Co.
Urbana, Ohio

For More Information Circle 644, Page 39

factory operation are marked for impregnation and shipped with the previously passed blocks to the company's plant in Trenton, Mich., where they are impregnated and machined. Before the blocks are shipped, however, the iron liners are demagnetized.

Liner Handling — The centrifugally-cast gray iron liners are shipped to the Chrysler diecasting plant on pallets from an outside supplier. Each liner is run through a qualifying machine to check for inside and outside diameter and length dimensions, as well as for concentricity.

Qualifying is done on a semiautomatic machine which ejects satisfactory liners to an inclined chain conveyor which elevates the liners and discharges them on a set of rails. The liners roll to an air cylinder elevator which lifts six at a time to position for pick up by the carriers on empty dollies returning from the trim press area.

The loaded dollies are conveyed into either of two storage banks—one for 6-in.-long liners and one for 7-in.-long liners. A dolly with the desired size liner is pushed out of storage to the constant power chain conveyor line to replace a dolly, carrying a cast block, which has gone off the powered line to the cooling conveyor.

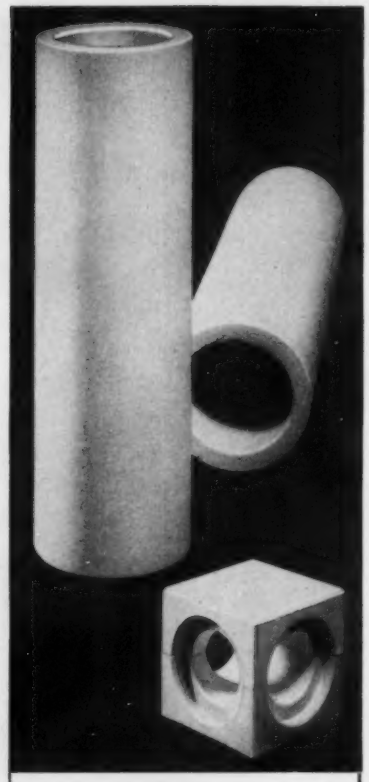
Currently, only 7-in.-long liners are used, because only the longer stroke, 225 cu in. displacement engine block is being diecast. The 6-in.-long liners are for use in the 170 cu in. displacement aluminum engine.

Book Review

Rare Metals Handbook, **edited by Clifford A. Hampel, cloth, 715 pages, 6¾ x 10 in., published by Reinhold Publishing Corp., New York. Price $20.**

This second revised and enlarged edition of a volume devoted to discussions on occurrence, production, properties, applications, and other factual data on rare or rather the less common metals was compiled by 44 experts. It presents currently available data on 55 metals.

Present volume includes six essentially new metals which did not appear in the first edition. They are cesium, chromium, plutonium, rubidium, scandium and yttrium.



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You minimize casting problems, get cleaner castings when you use Louthan refractory gate tiles (elbows and tees to match). They prevent erosion of the gates in steel castings, safely withstand high temperatures, will not react with the molten metal. All popular diameters and lengths can be furnished.

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EAST LIVERPOOL, OHIO

For More Information Circle 645, Page 39

YOUR KEY to Better, Cleaner Brass Castings...

Famous **CORNELL**
BRONZE & BRASS FLUX

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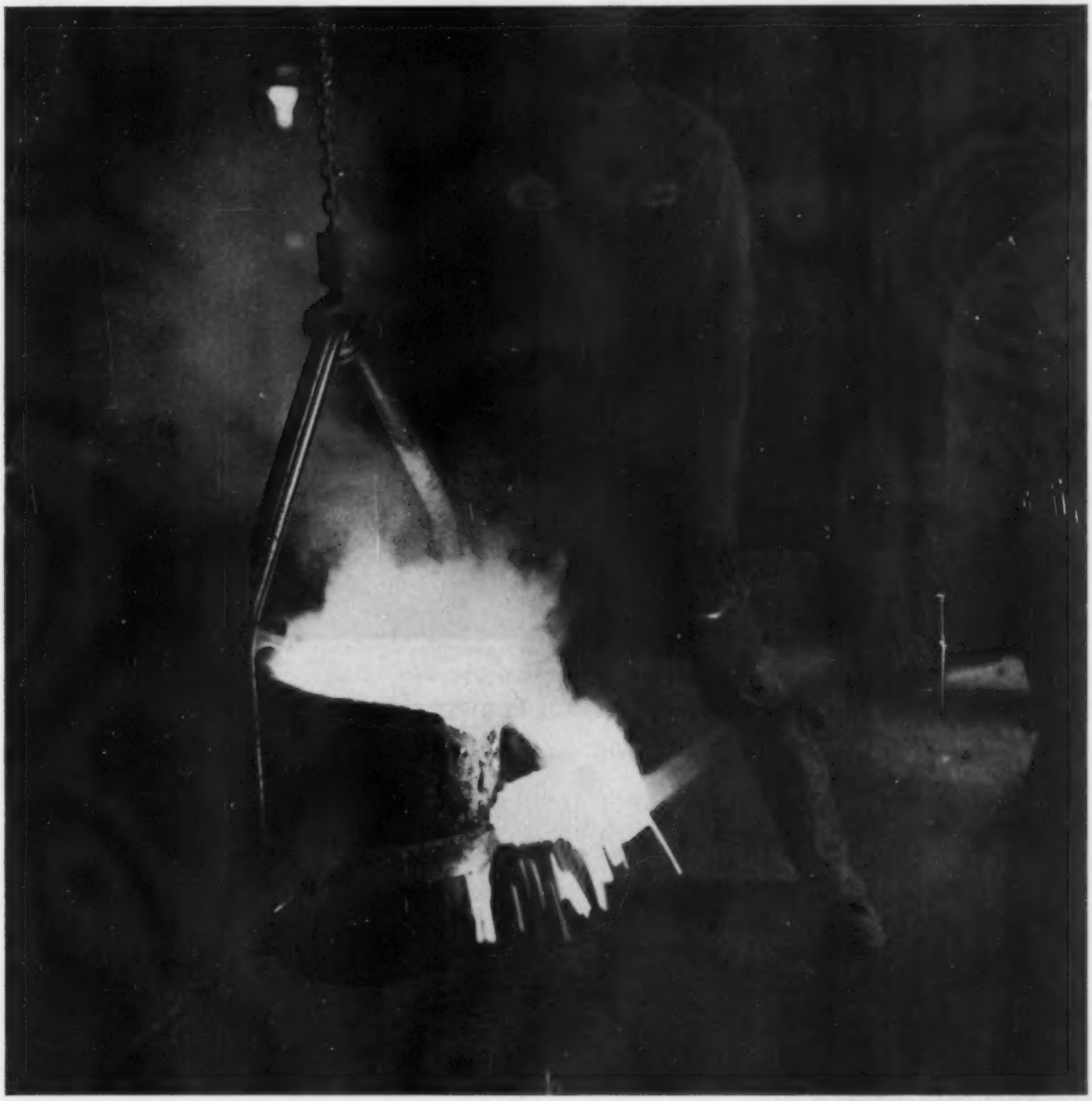

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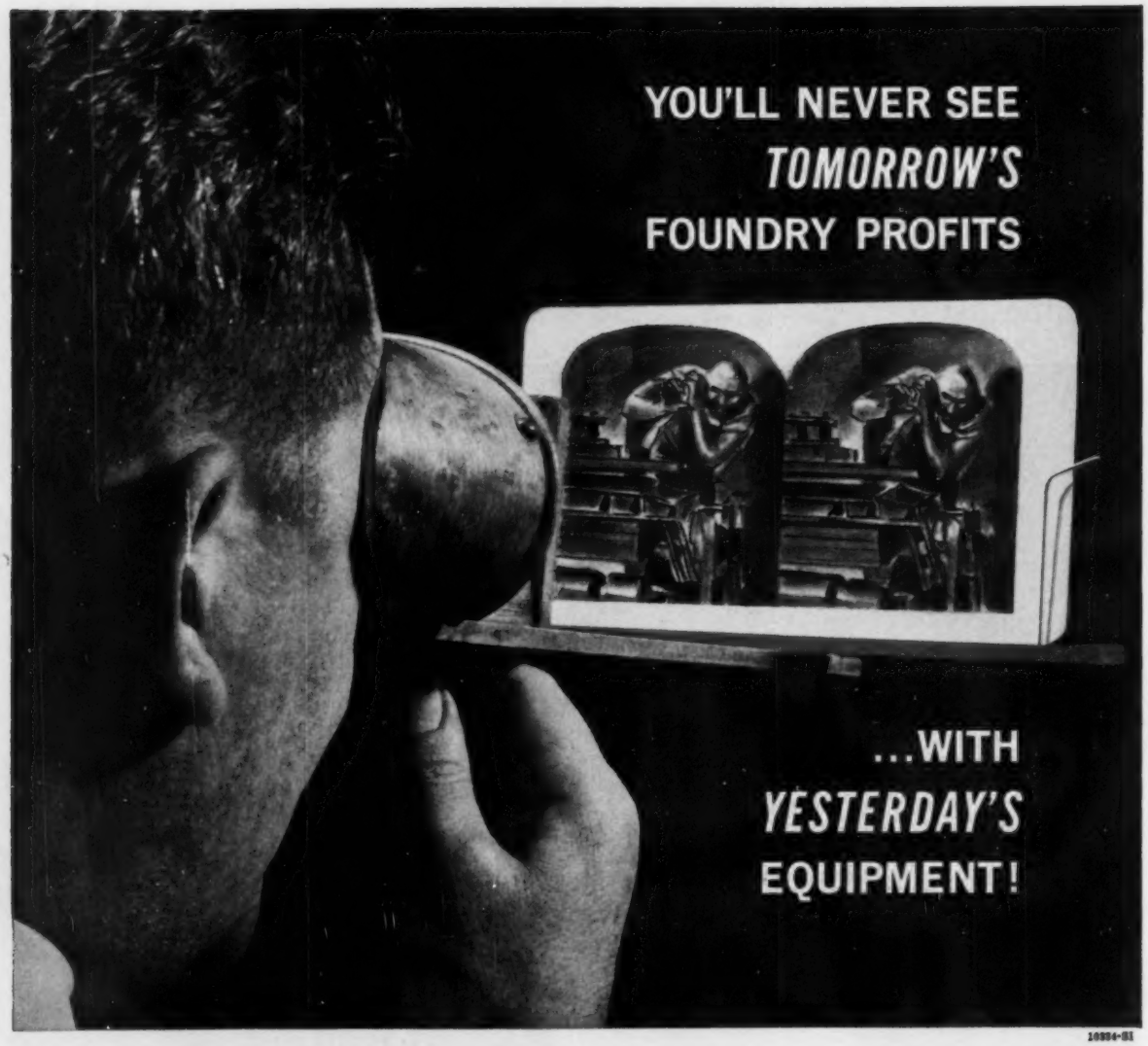

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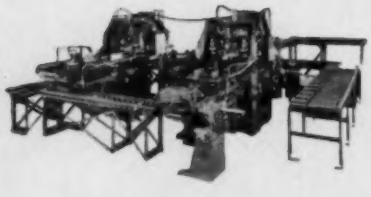

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Old machines and equipment are not necessarily "old friends" . . . and their hidden costs of operation can wipe-out your chances of survival in highly competitive situations.

Just as the old fashioned stere-o-scope has been replaced for "seeing", production mechanisms for the foundry have been replaced for "doing". It is important that we remind you that all improvements have not been devoted to total automation . . . and SPO has engineered a complete line of machines that will nudge your profit/loss figures well into the black.

For complete information, call DIamond 1-3666 or write today for additional information. You will be under no obligation . . . and the facts will serve you well.

THERE'S A **SPO MACHINE** FOR EVERY MOLDING JOB

Foundries Look for Strong Fourth Quarter

PHILADELPHIA — Casting demand is expanding moderately, with the probability that business in October will be up for the third consecutive month.

There is a greater diversity of inquiry and some acceleration in orders, not only to meet current requirements but also to build up consumer inventories, which had reached low ebb this summer. Most foundry operations, however, still are far from brisk and backlogs rather light.

Gray iron jobbers are averaging around 65-67 per cent of normal, and various shops still can promise deliveries within two weeks. Steel casting jobbers are operating at 55-60 per cent, with backlogs three to four weeks; and brass and bronze shops are at approximately 50 per cent with backlogs virtually nil.

Malleable shops, however, are running at a much better rate than a month or so ago. Some are operating at 75-80 per cent and at least one is booked ahead six to eight weeks, the best so far this year. Aluminum job shops are doing well at around five days a week but have little backlog.

Step-up in gray iron operations is ascribed in part to increased specifications for power transmission and material handling equipment and auto die work. Demand for building castings is sustained at a fairly good level. Demand from manufacturers of tobacco processing and papermaking machinery is slow but a shade better than a month ago.

Steel casting producers report a gain in requirements for heavy electrical equipment and chemical processing work. There is also an edging up in heavy mill equipment, including maintenance requirements. Railroad needs still are disappointing, but prospects are better in this line, and defense requirements are expected to have greater impact before the year is over.

Contributing to the improvement in malleable business is a gain in demand for electrical fittings, builders hardware, pipe fittings, and transmission line components. Railroad business still lags. Small tool requirements are holding up.

Over-all production in malleable has been retarded by a prolonged strike at one of the eastern Pennsylvania foundries.

Raw material supplies continue ample. Pig iron output has been stepped up by resumption of operations at the Birdsboro, Pa., stack late in August after a suspension of well over a year. A few weeks earlier, production was resumed at the Chester, Pa., furnace, also following a long suspension.

Demand Rises in New England

BOSTON—Castings production in New England will be the heaviest this year in the fourth quarter. Demand is moving upward although somewhat unevenly.

There is no boom, but pressure for shipments and an increase in bookings point to low inventories among most consumers. Foundries supplying castings to the building industry are at their peak for the year, and gray iron shops are operating 65 to 70 per cent of capacity with deliveries slightly more extended.

Machine tool volume has improved slightly, and in one instance a captive Rhode Island builder is more active. Machine tool volume generally is below normal, however, although there is some recovery from the slump prevalent during the first nine months.

Textile mill equipment producers vary as to activity; most are taking on jobbing work. Suspensions by strike held back a large valve manufacturer in September and this retarded some tonnage farmed out under subcontract.

Malleable castings have made a strong comeback after a slump at midyear. Production has bounced back to 80 to 85 per cent of capacity, and deliveries have lengthened to three to four weeks. Backlogs also are heavier at six to eight weeks for some shops. Malleable producers likely will be busy through the fourth quarter, although not at full capacity.

Brass and bronze shops share in the mild upturn, with demand diversified and operations near 75 per cent of capacity. Most brass and bronze shops are operating 40 hours a week; backlogs are not large, but orders are frequent, and they are accompanied by pressure for delivery.

RECEIVES GOLD MEDAL:. Shown making his acceptance speech is Carl Klingspor, president, American Crownflex Abrasive Wheel Mfg. Co., Delanco, N. J., after receiving a Diesel Gold Medal award from the German Inventors Association. He was given the award for inventing durable, high strength abrasives which can be used at high cutting speed

Steel Producers Hold Back

PITTSBURGH — Although district steelmaking operations are at the highest level of the year, foundrymen aren't participating in the upturn. August shipments of major steel foundries were no better than July's, and bookings for September promise little improvement. At gray iron shops, the picture is equally depressing. A leading producer says

YES...small foundries can afford mechanization

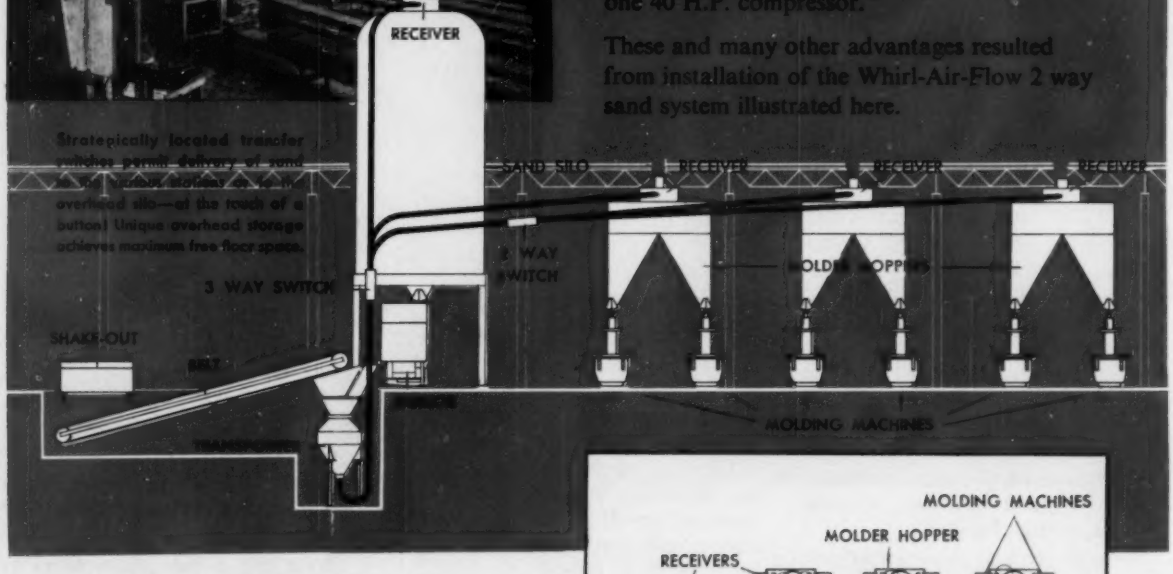
states Frank Ryan, President,
St. Paul Brass Foundry, St. Paul, Minnesota

Here is a summary of our savings over our previous operation.

40% Saving in sand handling labor
15% Saving in molding labor
15% Less scrap.

And we find air consumption extremely low . . . our whole plant operates on one 40 H.P. compressor."

These and many other advantages resulted from installation of the Whirl-Air-Flow 2 way sand system illustrated here.



BETTER SAND PROPERTIES...

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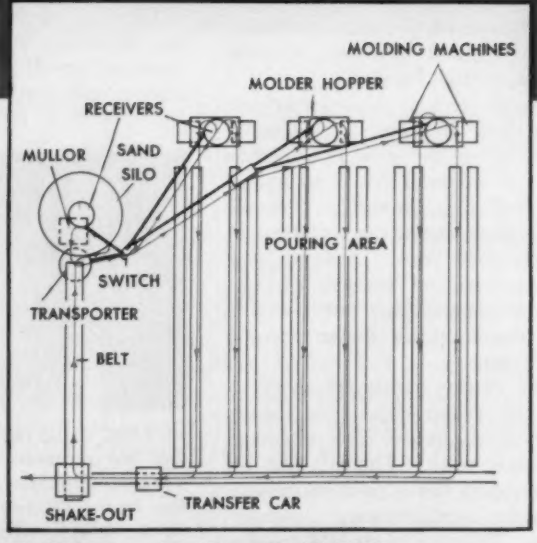
Green Compression	15 P.S.I.	16 P.S.I.
Permeability	21	23

TELL US YOUR HANDLING PROBLEM—Let us show you how Whirl-Air-Flow can boost your production and reduce costs in your plant.



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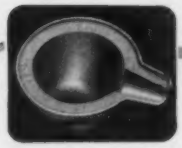

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Stocked in forty sizes and a complete range of styles, you can standardize on Acme melting pots and molds and be confident of immediate shipment at all times! Take advantage of all these benefits . . . proven over a period of more than 30 years.

FORTY SIZES IN STOCK

Quick delivery anywhere in the United States eliminates your "stand-by" non-ferrous pot and mold inventory. Write for bulletin listing all sizes and styles.

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FOUNDRY CO.

2502 22nd St., DETROIT 16, MICHIGAN

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For More Information Circle 649, Page 39

that its September bookings were worse than those of any month in the first half.

"Business isn't looking a bit better," one gray iron foundry commented, "and it's not because we're losing jobs to competitors. We're just not getting any work to quote. Half a dozen salesmen covering the East and the Midwest tell us the same story—nobody wants to buy."

Customers are ordering on a hand-to-mouth basis, forcing suppliers to carry inventory for them and to make deliveries on short notice. Foundries are having a hard time with their costs because delivery pressures force them to stay open on days when there's not enough work scheduled to pay for overhead.

On Oct. 1, foundrymen will be in an even tighter spot unless they can raise their prices. Wage rates are going up 7 cents an hour under terms of a two-year contract with the United Steelworkers. Foundry executives hope to pass the increased labor costs along to customers by raising prices of standard castings 3 or 4 per cent but they're not too confident that the increases will stick.

Demand for rolling mill rolls hasn't picked up as much as some producers expected. Steelmakers are keeping their inventories low and demanding fast service. If steel production reaches the fourth quarter level that market analysts foresee, roll sales will improve significantly. Given a strong fourth quarter, most rollmakers could close the gap between this year's and last year's sales.

Chicago Engine Plant Is Sold

CHICAGO—Two parcels of the former huge vacant Ford aircraft engine plant at 7401 S. Cicero Ave., Chicago, have been sold by the federal General Services Administration for $3,401,500 to Chicago Industrial District Inc. The company plans to build a shopping center and industrial park on the site.

It is understood the sale represented about one-tenth of the original cost to the government.

Included in the purchase are 232 acres of the 532-acre site and 32 of some 50 buildings. The main building, with 83 acres of floor space under roof, was known as one of the largest one-story manufactur-

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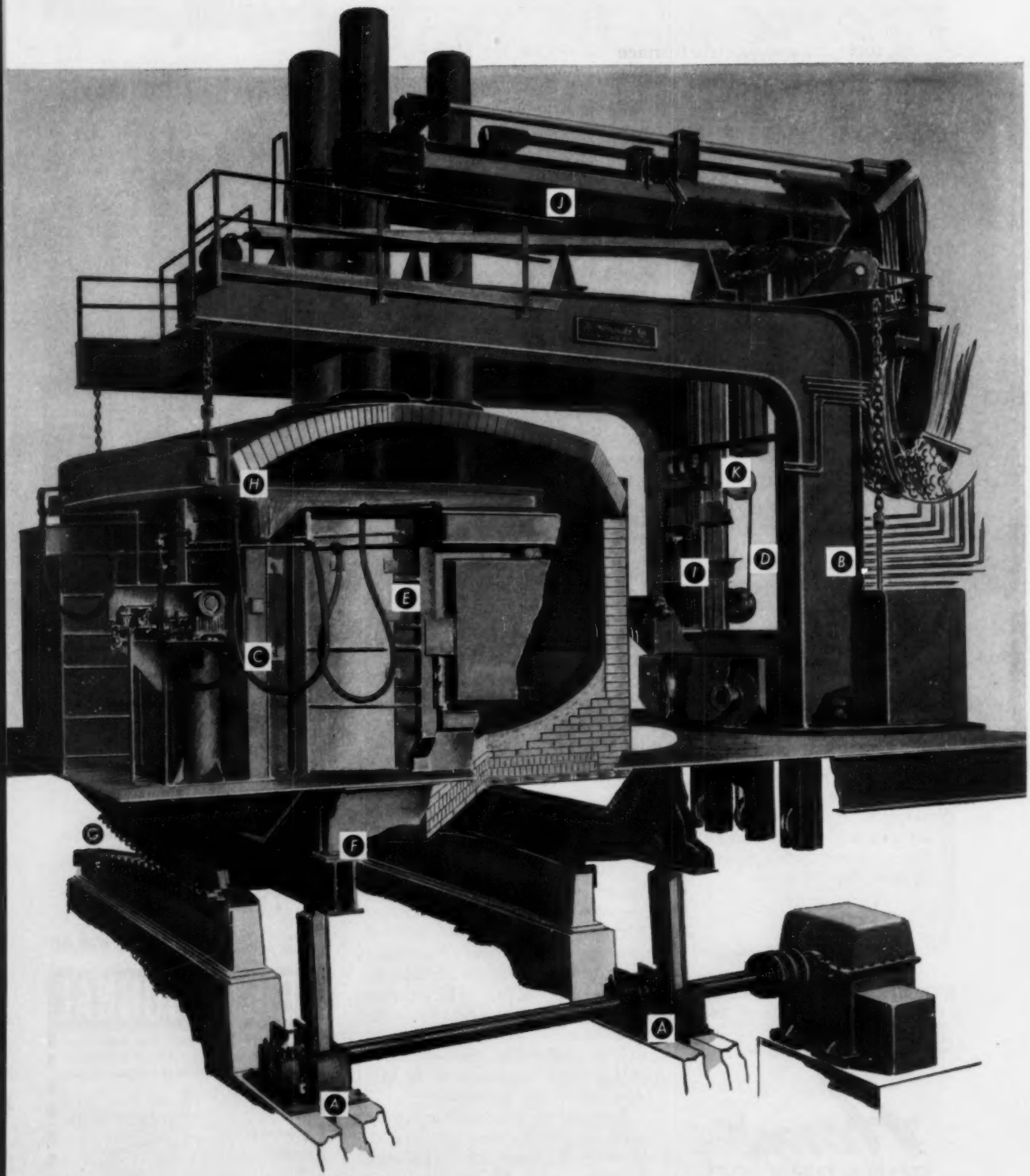

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The oldest, most famous electric furnace is also the most modern. Completely up-to-date in every respect, the speed, yields and quality of melts produced by a Heroult electric furnace cannot be surpassed. Check the vital features of the Heroult electric furnace and see for yourself.

The Heroult is as versatile as it is efficient. With a capacity range of 3 to over 200 tons, the Heroult can handle either ferrous or non-ferrous melting, can be charged through top or door, can accommodate induction-stirring equipment, and can be adapted for duplexing.

If you're looking for performance, efficiency, economy and low-cost maintenance, consider these features:

1. Heroult Furnaces are 100% mechanically operated. Including **(A)** heavy rack-and-pinion-type tilting mechanism, **(B)** motor-driven, rotating, jib-type roof swing, **(C)** winch-operated, water-cooled, jib-type door-lift mechanism, and **(D)** high-speed, electro-mechanical electrode-positioning mechanism.

2. Cage-type shell construction with shell plates loosely attached **(E)** to heavy supporting structure. This construction minimizes shell warping and allows easy replacement of damaged shell plates.

3. Operating mechanism independently supported. The tilting platform on which all operating mechanisms are supported is attached directly to the rockers independent of the shell structure **(F)**. Thus, operating mechanisms are unaffected by shell distortion.

4. Water-cooled, Skew Back Roof ring. This feature **(H)** eliminates the need for special skew-shaped roof refractories.

5. Electrode Mast Safety Device. This spring-loaded, rack-and-pawl-type device **(I)** provides positive protection against damage resulting from electrode winch cable breakage.

6. Square-section, Water-Cooled Electrode Mast Arms. This design **(J)** guarantees a rigid connection between mast and mast arm, thus helping to maintain proper electrode position.

7. Remote-Controlled Electrode Clamps. This device, of the spring-clamp, air-release type, is located inside of the rear section of the water-cooled mast arm where heat cannot affect it.

8. Square-Sectioned Electrode Mast. This design feature **(K)**, developed by American Bridge, assures proper guiding and electrode positioning.

9. Rockers. The heavy fabricated steel curved top and bottom rockers **(G)** minimize forward travel during tilting. These rockers are designed so that the furnace will tend to return to horizontal position from any degree of tilt.

Next time you want to increase or improve your production, call American Bridge. We offer complete electric furnace design, construction and installation.

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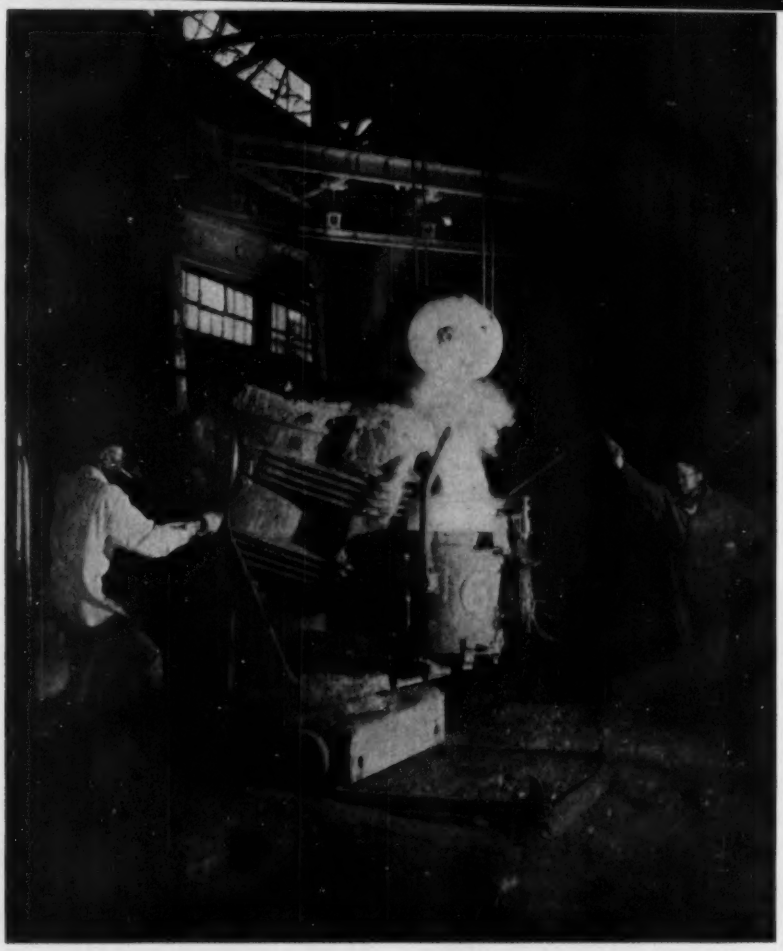
USS



"PASSING THE BATON"— FROM WHITING TO WHITING

The big Whiting Distributing Ladle has been storing the melt. Slag, rising to the top, has hardened to form a natural lid and retain the heat below. Now the "baton"—a stream of slag-free metal—is passed through the outside teapot spout into a Whiting Pouring Ladle with bottom tap for final relay to the molds.

This scene is typical of efficient foundry operations throughout the world. Whiting engineers, practical foundrymen themselves, have designed more than 200 types and models of metallurgical ladles to reduce costs, speed output and improve casting quality in every pouring operation. If you have a special need, they'll design a special ladle to meet it precisely. And there is no charge for this service. See your local Whiting rep or write direct.

FREE: Bulletin FY-163-R, *WHITING LADLES.* Forty pages of illustrated ladle models and accessories to cut your casting costs. Write for it today. *Whiting Corporation, 15607 Lathrop Avenue, Harvey, Illinois. In Canada: Whiting Corporation (Canada) Ltd., 350 Alexander Street, Welland, Ontario, Canada.*

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MANUFACTURERS OF CRANES; TRAMBEAM® HANDLING SYSTEMS; PRESSUREGRIP; TRACKMOBILES®; FOUNDRY, RAILROAD, AND SWENSON CHEMICAL EQUIPMENT

FOUNDRY EQUIPMENT

For More Information Circle 652, Page 39

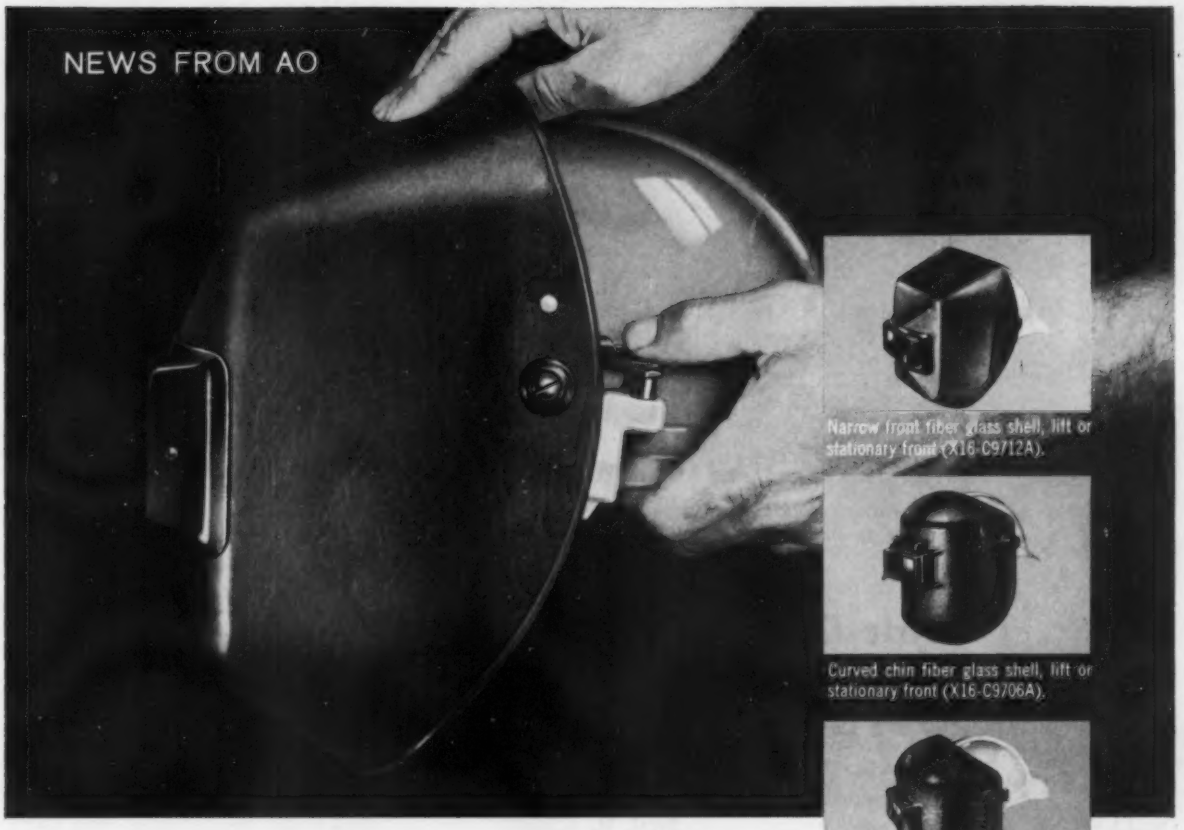
ing structures in the world. Some of the smaller buildings may be demolished. The company had previously purchased 38.9 acres of the site and will seek an option on the remaining acreage.

Idle for the last two years, the plant was built for the government in 1943 by the Dodge Div. of Chrysler Corp. to manufacture aircraft engines and subsequently was acquired by the late Preston Tucker to make his ill-fated Tucker automobile there. The company went bankrupt. During the Korean War, the plant was reactivated by Ford Motor Co., which had contracted with the government to build reciprocating engines and later jet engines.

Still unsold are the former aluminum and magnesium foundries. These were twin structures. The aluminum foundry, offered for sale as Parcel 3, is situated on 50 acres and has 457,660 sq ft of floor space. The magnesium foundry, designated as Parcel 4, is on 38 acres of land and has a floor area of 420,131 sq ft. The aluminum foundry is 95 per cent empty, and the magnesium foundry is 95 per cent full of heat treating equipment mostly.

The magnesium foundry was closed in late 1954 when the volume of castings required by the jet engine program no longer justified operation. Aluminum foundry operations were suspended earlier—when the reciprocating engine was being phased out in favor of the jet engine.

"I just walked past your blast pressure gage and it was reading May Day."



Narrow front fiber glass shell, lift or stationary front (X16-C9712A).

Curved chin fiber glass shell, lift or stationary front (X16-C9706A).

Curved chin fiber glass shell, heat-reflective coating, lift or stationary front (X16-C9702WA).

Straight front fiber glass shell, lift or stationary front (X16-C9602A).

Flexible mask with stationary welding plate (X16-C488).

Welders' coverglas goggles (X16-C329B).

Now... One Easy-to-Use Clip Fastens Any of These Attachments To an AO Safety Cap

You can use any of these accessories with regular AO Dura-Guard safety caps . . . all you need is a pair of AO's simple X30 clip-on attachment holders. Molded of nylon, they slide easily over the side brim and are secured by nylon set screws which hold them tight. No drilling. No holes. No need to stock caps with attachments. Just apply clips to regular stock of caps.

Choose from 10 welding helmet models (both fiber glass and vulcanized fiber, lift or stationary fronts), flexible mask welding goggles, and welders' and chippers' coverglas goggles. All are quickly and simply attached to the Dura-Guard safety cap by slipping the attachment post into the hole provided. It locks securely into position, can be detached in seconds when you want to remove it.

Because they are all-plastic, the X30 clips insulate metal attachment parts, help retain the Dura-Guard cap's dielectric properties. You can get complete details on all these new accessory helmets and goggles by contacting your AO Safety Products Representative or writing direct.

Your Surest Protection... AO SURE-GUARD Products

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For More Information Circle 653, Page 39

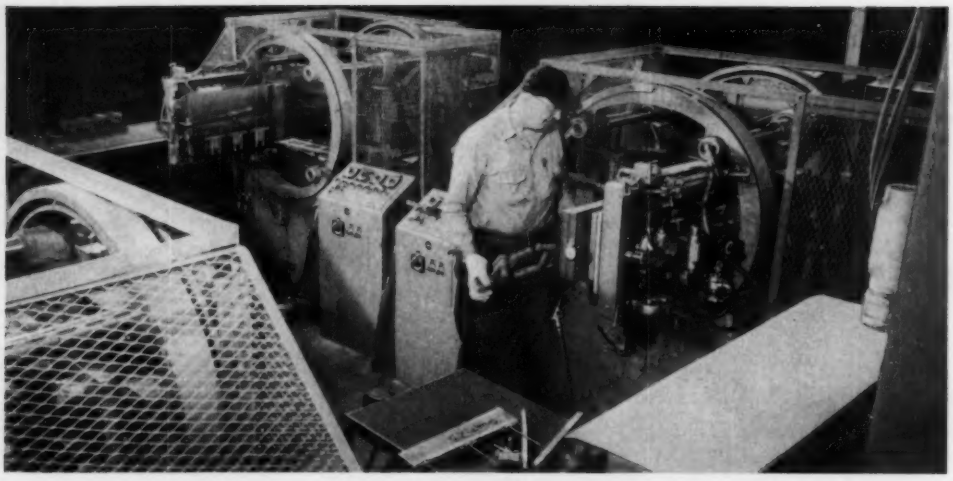


Fig. 1—Operator unloads a core from one of four shell core machines he operates. He will place it on the conveyor, upper left, which takes it to the core inspector

Cuts Costs with

SHELL COREMAKING

By C. H. ALVORD
Industrial Consultant
Pittsburgh

● KEEPING AHEAD in productivity was a prime reason behind the switch from oil and sand to the shell core process by Crouse-Hinds Co., Syracuse, N. Y. We consider the resulting improvement in production to be outstanding since one man, with the proper combination of jobs, now can produce up to 7000 cores during a 7½-hour work day with a reduction of as much as 50 per cent in costs.

The new method eliminates a long baking operation, several handling operations, and, in some cases, such operations as washing and pasting required by our former procedure.

The decision to switch to shell cores was based largely on the need to produce electrical fittings having interior surfaces which would not injure the insulation of wire when it was inserted.

Sand Cost Unchanged—Studies indicated that sand costs for small shell cores would be somewhat higher but that there would be substantial savings on the larger cores —the two offsetting each other and resulting in no increase over former practice.

The first shell core machine chosen was a National Acme Shalco unit having electrically heated platens. In practically every case, the master patterns already in existence readily could be remodeled with wax and recast for operation with the heated platens. It was realized, however, that more cores would have to be blown at higher temperatures and during shorter cycle times than was anticipated originally. Therefore, tests were run on the unit to determine cycle times, construction and treatment of coreboxes, handling procedures, and other details related to shell core production.

After all tests, two additional units were purchased, providing a production line of three machines run by one operator. Finally, a fourth unit was purchased to permit make-ready and set-up time for

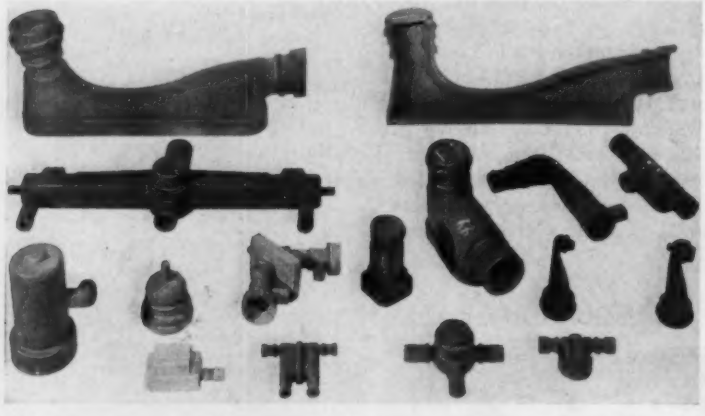


Fig. 2—Typical shell cores produced by the machines at the Crouse-Hinds Co. foundry. Some coreboxes have as many as eight cavities

Computer Analyses Now Make Tenzaloy Better Than Ever

TENZALOY

Asarco has introduced another significant advance in aluminum casting alloy technology—computer correlation of composition and properties of its widely used high-strength, self-aging Tenzaloy. Results: Further refinement in quality and reliable performance of this superior alloy.

Data for the pioneering computer analyses were drawn from a long record of properties and composition of Tenzaloy plant heats compiled by Asarco's Central Research Laboratories. From these studies has come new knowledge of the interaction of Tenzaloy elements and effects of alloying ingredients on mechanical properties.

Computer findings now enable Asarco metallurgists to control Tenzaloy mechanical properties to a much narrower range of variation and to higher average values than ever before—and to reproduce them precisely and consistently over and over. There is only one Tenzaloy and it cannot be duplicated.

TYPICAL PROPERTIES OF TENZALOY

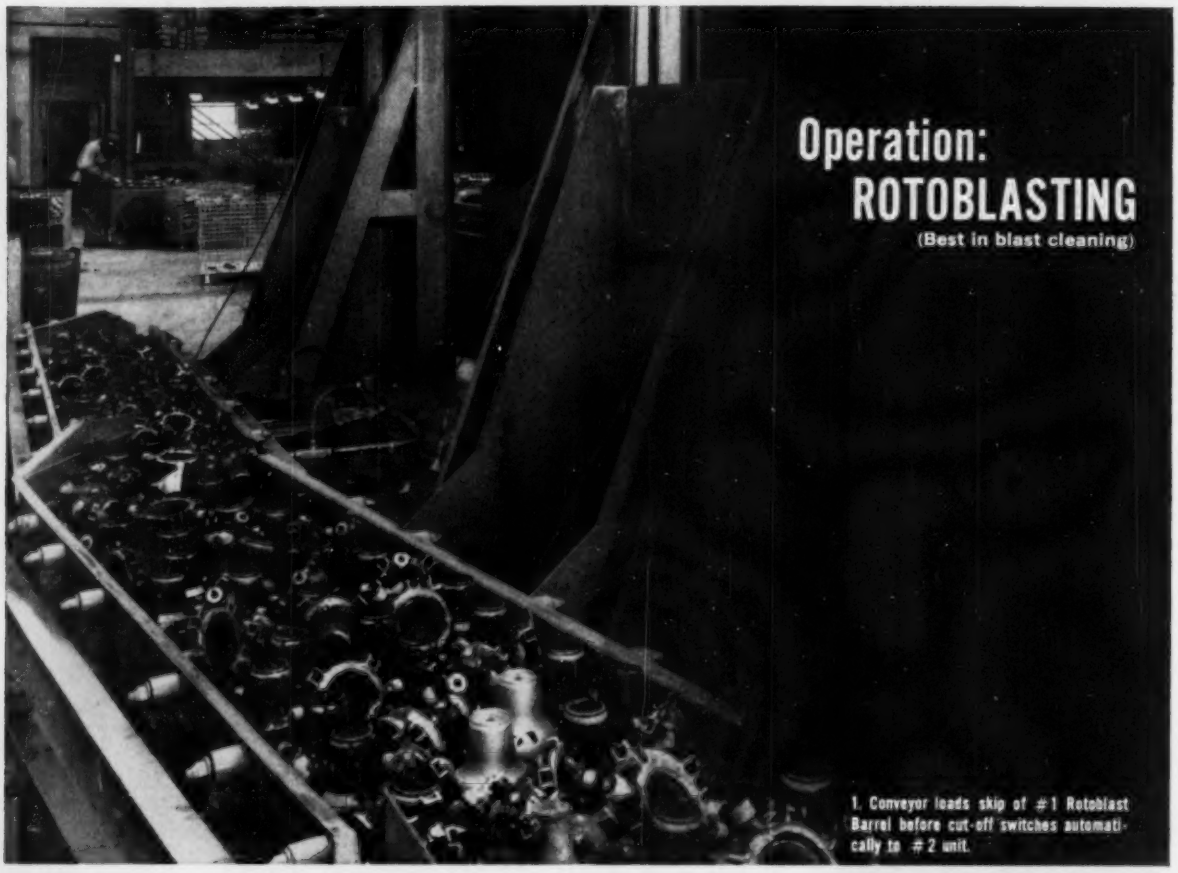
	SAND CASTINGS	PERMANENT MOLD CASTINGS
Tensile Strength	35,000 psi	40,000 psi
Yield Strength	25,000 psi	27,000 psi
Elongation (in 2")	4-5%	6-7%
Brinell Hardness No.	74	74
Impact Strength (Charpy in ft./lbs.):		
Notched	3	3
Un-notched	14	20
Electrical Conductivity	30%	30%

Tenzaloy can widen design horizons, increase production efficiency, reduce costs and improve your products. For your copy of Bulletin 103R5, "Tenzaloy, the Self-Aging Aluminum Casting Alloy," write today to: Federated Metals Division, American Smelting and Refining Company, 120 Broadway, New York 5, N. Y.

ASARCO

For More Information Circle 654, Page 39

Burroughs B205 computer correlates unique composition and properties of Asarco's high-strength Tenzaloy.



1. Conveyor loads skip of #1 Rotoblast Barrel before cut-off switches automatically to #2 unit.

Complete automation in blast cleaning!

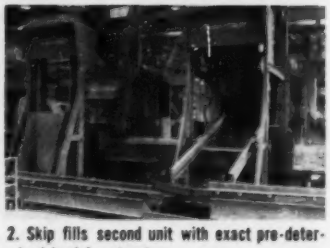
Pangborn Rotoblast removes heavy sand cores and cleans up to 45,000 castings per shift at Neptune Meter!

A new and *completely automatic* Rotoblast operation not only cleans castings in half the time, but a new special separation removes heavy sand cores as well at Neptune Meter Co., Long Island City. The world's largest exclusive manufacturer of meters for liquids, Neptune can now handle 45,000 castings from the molds each shift . . . with just two automated Rotoblast Barrels.

No costly or time-consuming manual lifting, toting or weighing here! Once the button is pressed, the Rotoblast sequence starts and recycles automatically until stopped at the end of the shift!

Whether your installation features automation or batch cleaning, Rotoblast cleaning efficiency can cut *your* operating and manpower costs. Flexibility of installation, ease of maintenance, durable construction—all contribute to lower overall cleaning costs.

Write PANGBORN CORPORATION, 1400 Pangborn Blvd., Hagerstown, Md., Pangborn Canada, Ltd., 47 Shaft Road, Toronto (Rexdale), Canada; or phone district office in Yellow Pages, "Sand Blast Equipment." *Manufacturers of Blast Cleaning, Vibratory Finishing, Dust and Fume Control Equipment—Rotoblast® Steel Shot and Grit®.*



2. Skip fills second unit with exact pre-determined load for cleaning.

3. Cleaned castings move on take-away conveyor to next operation.

4. Before and after Rotoblasting. Note core sand and rods in uncleaned piece.

Pangborn
OF HAGERSTOWN

For More Information Circle 655, Page 39

the next job. Actually, with the four machines available, it was found that for many combinations of jobs, the one operator could efficiently run the four machines, and most jobs are now operated on this basis. This multiple-machine operation by one operator, Fig. 1, is an important fundamental condition which results in the low core cost from these machines.

Efficient Handling—Fig. 3 shows the production layout. Note the arrangement of right and lefthand doors for efficient handling of the cores by the operator. The belt moves at a speed slow enough to allow two minutes for core curing from machine to final handling.

Efficiency of the entire production setup is demonstrated by the need for as many as three men to handle cleaning, inspection, and packing of cores produced by one operator.

Resin content of the coated sand used varies from 2½ to 4 per cent depending on the shape, weight, and composition of the ferrous or nonferrous casting. A sand of approximately 85 grain fineness was found suitable for practically all conditions, the only variable being the percentage of resin used. It also was learned that sand with the least amount of fines causes less wear on the edges of corebox cavities and requires less resin to obtain needed core strength.

In tooling for these machines, most of the standard aluminum oil-sand coreboxes were found to be unsuitable for shell use with electrically heated platens. Expansion tables were established to determine the cold dimensions of the coreboxes, to compensate for expansion from the 500 to 550° F operating temperatures, and for shrinkage of cores on cooling. Different expansion tables are necessary for the iron and aluminum boxes; in some cases tables were different for cores used with ferrous and nonferrous castings.

Although the units are completely automatic, core ejection is semi-automatic and always under the control of the operator. Large single cavity cores and some intricate two or three cavity cores are removed by hand. In higher production jobs, which may range up to eight cavities per shot, the cores are removed in one operation by wooden rakes.

To date, core sizes have ranged from 2 to 30 in. in length and from 1 oz to 20 lb in weight. Fig. 2 shows the variety of cores produced by reasonably simple coreboxes.

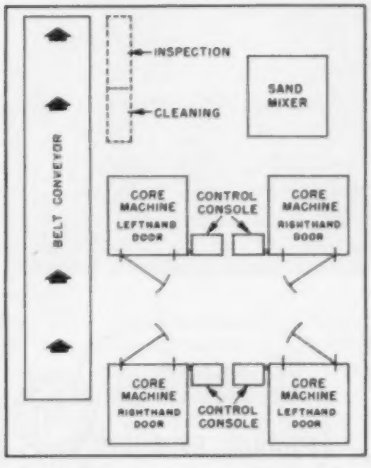


Fig. 3—Layout of the shell core machines. Notice the arrangement of doors for efficient core handling

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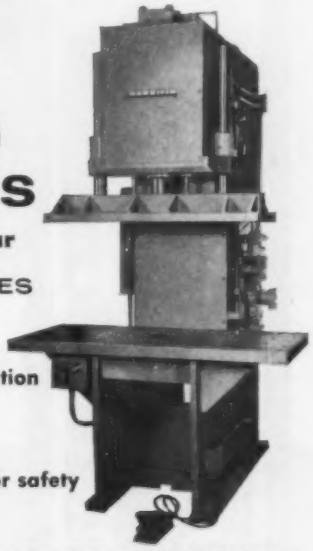

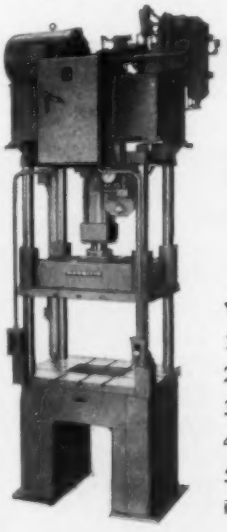

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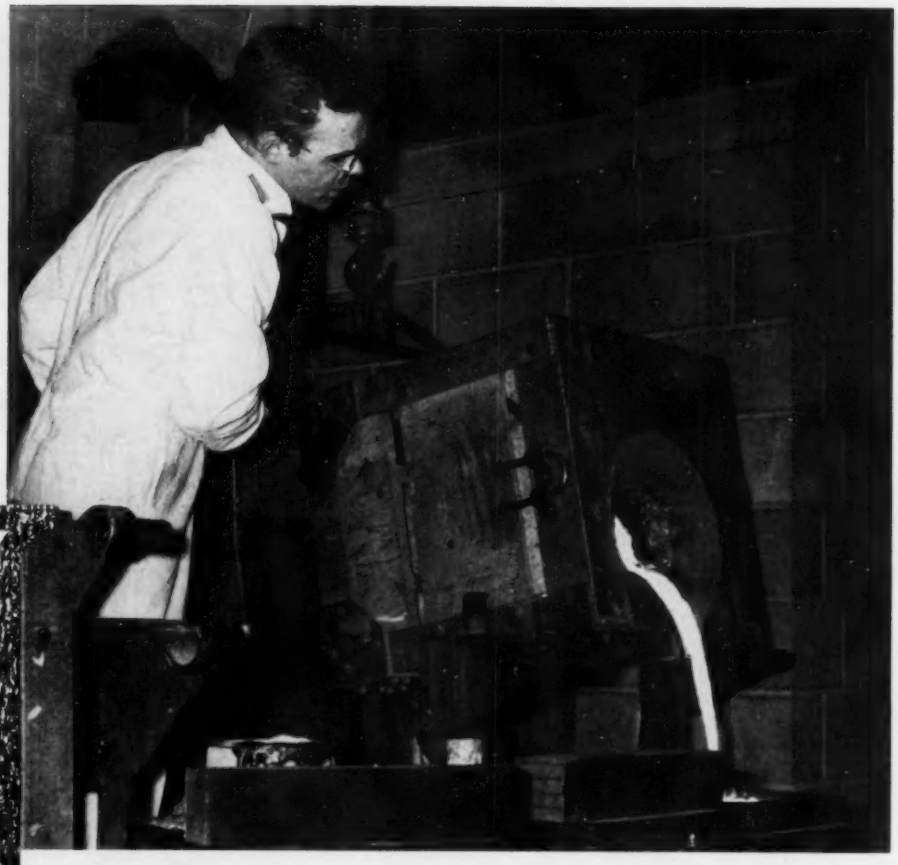

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For More Information Circle 657, Page 39

Above, students view casting display. Above right, a group of students inspect large patterns. Below right, Dale Anderson, Minneapolis Electric Steel Castings Co., describes various physical tests to industrial arts students visiting the foundry. Below, the visitors look at a row of finished molds just prior to pouring

Program Tells About

CASTINGS and FOUNDRIES

Twin City Chapter, AFS, has developed a program which describes the foundry industry to high school industrial arts students and teachers. The program features a lecture, display, slides, and foundry tour

By MATT GRANLUND
Archer-Daniels-Midland Co.
Minneapolis

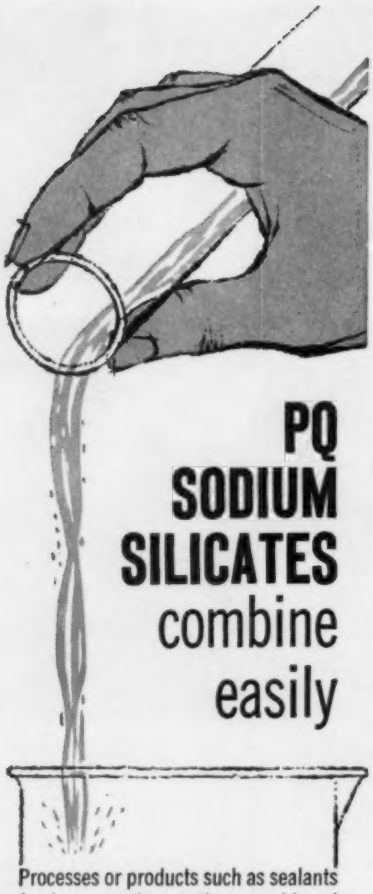
● PRESENTING the foundry industry to high school industrial arts classes is the purpose of a program developed by the Educational Committee, Twin City Chapter, American Foundrymen's Society. More specifically, the program is designed to familiarize the students and teachers with metal casting principles, to show students the opportunities available in the foundry industry, and to acquaint them with the function and status of the foundry industry in the industrial community.

The committee presents the program, known as "The Birth of a Casting," to industrial arts classes whose instructors respond to an introductory letter. The program consists of the following parts: 1. Display. 2. Lecture. 3. Slide presentation. 4. Question-and-answer period. For interested classes, the committee also arranges tours to nearby foundries.

The letter of acquaintance, which is sent to various schools in the Minneapolis-St. Paul area, outlines the program and what it intends to accomplish. A program is scheduled with a class when an instructor shows interest. Only two presentations were made during the first year, but in the past year six or seven presentations were made. The program has been limited to the immediate area, but the committee is planning one program outside the Twin City area.

Steps in Production—The display illustrates the step-by-step development of a casting. All parts of the display, which includes a blueprint, master pattern, matchplate, completed cope and drag, casting with attached gating system, and finished casting, are labeled and mounted on a peg board. The sample mold is made of brown plastic, instead of sand, to make the display lighter and more durable.

The lecture presents the story of a casting from the beginning to end. The amount of material covered and the level of each presentation depend on the audience's



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Processes or products such as sealants for impregnating castings; mold and core binders; cements; wire drawing; fire-resistant coatings—all need the dependable quality of PQ silicates. From those with slightly sticky consistencies to heavy viscous solutions, the right silicate is available at PQ for all your formulas. Alkalinities are from 6.75% to 19.7%, and soluble silica range is from 19.9% to 36%.

EASY TO HANDLE

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Tell us about your need for sodium silicate; we will be glad to send further information and samples promptly.

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For More Information Circle 658, Page 39

foundry knowledge. A typical lecture begins by enumerating familiar examples of castings such as plumbing fixtures, steam radiators, automobile engine blocks and heads, railroad car wheels, type with which newspapers are printed, propellers on outboard motors, and most basic parts of machinery and vehicles.

The lecturer begins the story by describing why the designer selects the casting process and specifies a certain metal. Next, he tells how the blueprint goes from the designer to the patternmaker whose job is making a pattern and corebox from the drawing. Then, the lecturer explains how the foundryman uses the pattern equipment to make a mold. He also discusses metal melting and pouring. Finally, he describes the finishing operations necessary for various types of castings.

To augment the lecture and display, the committee presents a series of slides. Originally, the slides were donated by various foundries, but now the committee is acquiring the specific slides it wants to complement the talk.

The question-and-answer session gives the students a chance to ask about points they do not understand. Typical questions are: "Can the mold be used again?" "Can the sand be used again?" "Why is a great variety of metals used?" "Why is a variety of melting processes used?"

Tours Provided—A foundry tour provides the student an opportunity to see all that was described and shown to him in a presentation. Foundries in both cities have been co-operative in setting up these tours.

The committee is convinced that this is the best type of program to interest students to be foundrymen. Each presentation is made by two members of the committee with the responsibility being passed around so that all members do their share. As a result of the success of the program, the committee aims to make the project a continuous one.

Changes Name to Pyronics Inc.

Bryant Industrial Products Corp., Cleveland, has changed its name to Pyronics Inc. The new name is a coined word which is defined as the systems concept of combustion application.

REVECON: Non-crucible. Melts Monel, brass, bronze, aluminum, gray iron and high alloys. Sizes: 50 lbs. to 30 tons.

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Foundries are guaranteed a maximum 1% metal loss in aluminum and 2% maximum metal loss in brass at normal pouring temperatures. This means your furnace can pay for itself within one year.

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REVERABLE: Dip-out furnace for yellow metal and aluminum permanent mold casting. Non-crucible. Sizes: 300 lbs. to 900 lbs. per hour.

Canadian Representative: Drew Brown Ltd. 5410 Ferrier St., Montreal 9

For More Information Circle 659, Page 39

CAST METALS IN ENGINEERING EDUCATION . .

PENNSYLVANIA STATE UNIVERSITY

Engineering education in cast metals at Penn State is centered in the Department of Industrial Engineering, headed by Professor Benjamin W. Niebel. Assisting Niebel in the foundry area are Assistant Professor Wesley P. Winter and Assistant Professor Alan B. Draper.

The Pennsylvania State University, chartered in 1855 by the Legislature as The Farmers High School, opened with a class of 69 students in February, 1859. The institution was designed to give young men "a knowledge of the English language, grammar, geography, history, mathematics, chemistry, and such other branches of the natural and exact sciences as will conduce to the proper education of a farmer." In the 1860s the college enlarged its scope to include the "mechanic arts," began to admit women students, and started to increase its enrollment and enlarge its physical plant.

Big Investment in Research

Today its nine colleges offer 65 undergraduate curriculums. The student body has grown to over 21,600, and Penn State ranks twelfth in the nation in full-time enrollment. In addition to resident education, the University has two other main functions, continuing education and research. Research at Penn State today calls for an investment of more than $10,000,000 annually.

Under Many Roofs

The main campus, University Park, is 40 miles from Altoona and close to the geographic center of the commonwealth. Of the 4123-acre University Park campus, 389 acres are used for classroom and office buildings, laboratories, and residence halls. There are 160 principal buildings on the main campus. The total valuation placed upon the entire university plant is approximately $107,600,000.

Nine Courses in Cast Metals

More than 500 engineering students and approximately 250 engineering "associates" are enrolled in the nine courses offered which pertain to cast metals. A well equipped foundry laboratory affords students an opportunity to apply engineering science to the metal casting process. Since the university became affiliated with the Foundation in 1950, over 140 capable and deserving students have received FEF scholarship assistance. Penn State men can be found in positions of leadership throughout the foundry industry.

FOUNDRY EDUCATIONAL FOUNDATION, Terminal Tower, Cleveland, Ohio

The Foundry Educational Foundation does not pay for this advertising. This advertisement has been prepared and the space contributed by FOUNDRY magazine in support of FEF's constructive program for foundry industry progress through education.

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Many foundrymen say American STARRBIDE Crucibles are best because they can really take it . . . when the heat's on! This is because they are made of a special, carbon bonded material that gives them **greater strength** to resist the conditions which shorten crucible life. It is also the secret of STARRBIDE'S **exclusive thin wall** design which offers you these advantages . . .

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★ **Less Fuel Per Pound of Metal**

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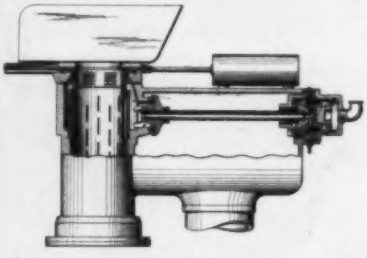
PATENTS of INTEREST

Mold Blower

Mold blowing or shooting machine incorporates an improved venting device for relieving the pressure in the sand chamber after the operation. It is comprised of a hollow, open-ended valve rod to actuate the valve and is in the air reservoir of the machine. Rod is axially movable and arranged to open the inlet valve which admits air into the sand chamber. Opposite end



of the rod is attached to a piston operating against a spiral spring which holds the inlet valve in the closed position. In operation, air under pressure is admitted into the air reservoir, and the valve is closed. Then compressed air is admitted against the piston face, causing the hollow rod to move and open the inlet valve. At the same time the opposite end of the rod is forced against a seal. When the air pressure on the piston is released, the spring causes the rod to move back to its original position, closing the inlet valve and permitting the venting of any air in the reservoir to the atmosphere. *Patent No.* 2,983,-971 *granted to Fritz Hansburg.*

Silicate Binder

Sodium silicate binder for cores and molds which provides products possessing high strength and excellent collapsibility is comprised of an aqueous solution of sodium silicate having a concentration between 30 and 50° Be and a SiO_2 to Na_2O ratio of at least 2:1 plus 1 to 15 per cent by weight of an organosilicone additive.

The organosilicone additive may be composed of about 75 mole per

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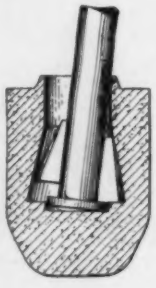
cent of monomethylsiloxane, about 24 mole per cent of dimethylsiloxane and 1 mole per cent of trimethylsiloxane with about 6 per cent by weight of silicon-bonded isopropoxy groups being contained in the polymer molecule. *Patent No.* 2,975,494 *granted to R. H. Cooper and assigned to Dow Chemical Co.*

Stopper Assembly

Solid nose stopper for bottom-pour ladles is designed to decrease erosion at the bottom as well as to partially insulate the rod from the stopper, and to permit easy and rapid assembly of rod and stopper. The stopper contains a downward extending bore which merges with an undercut tapered recess.

Rod containing a flange or washer at the lower end is inserted in the



bore to the recess. The rod is tilted to permit insertion of several wedge shaped blocks or locking members. Then the rod is aligned in the vertical position, the voids partially filled with fine refractory grain, and the rod cemented in place. *Patent No.* 2,987,787 *granted to S. B. Seeley and assigned to Joseph Dixon Crucible Co.*

Investment Molding

In manufacture of investment molds by the Shaw process it is desirable to prevent rapid evaporation of volatile material in the gelled slurry during removal of the mold from the pattern. Such evaporation, which tends to cause shrinkage of the mold, is minimized by coating the bottom, sides and working face, if desired, with wax such as beeswax dissolved in carbon tetrachloride.

The practice is particularly useful in preparing mating mold halves from a one-piece pattern. After the molds are completed they are ignited

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For More Information Circle 663, Page 39

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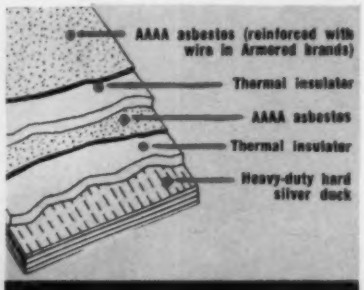
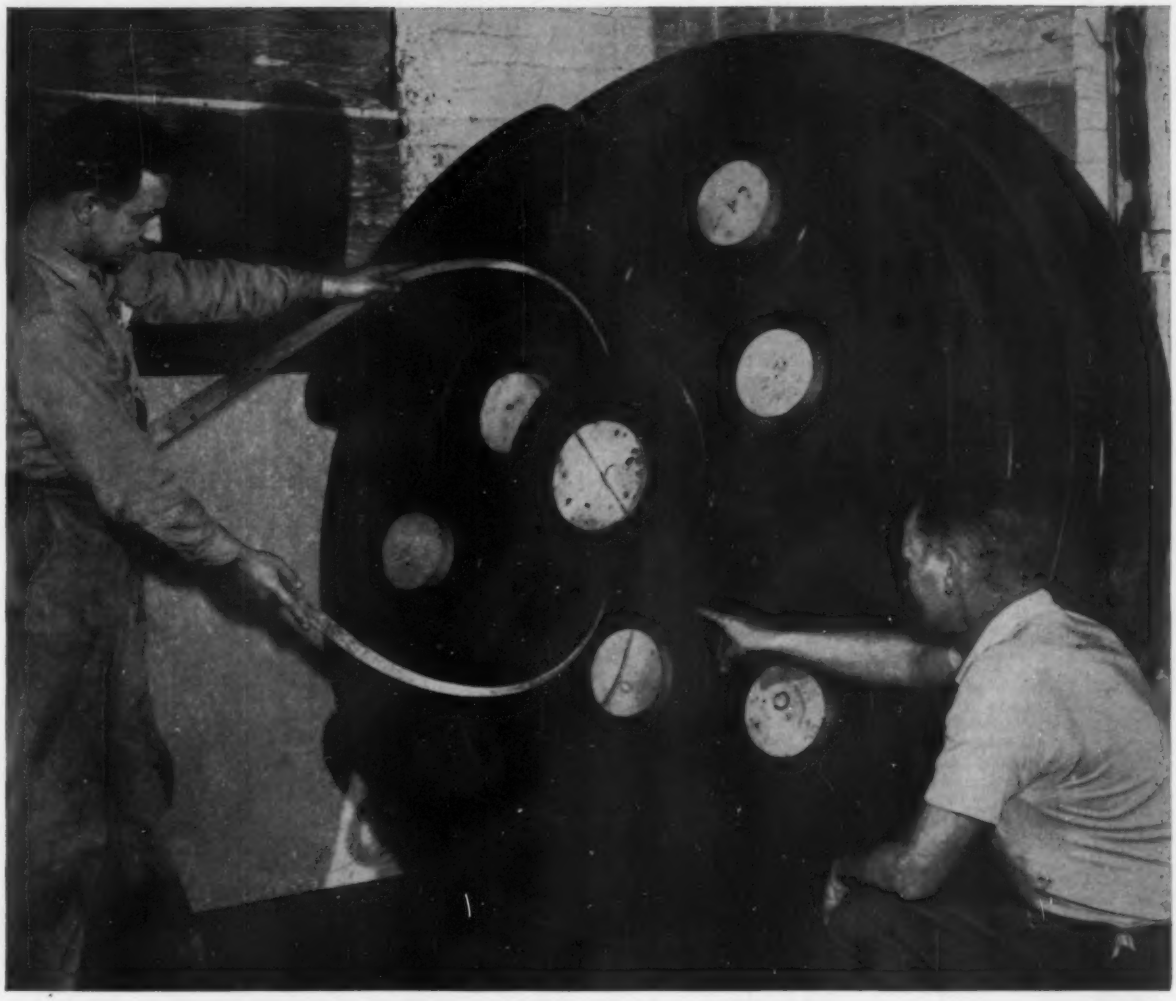
That's why it outlasts ordinary hot belting as much as 3 to 1 . . . gives you better performance, longer life, more value for every belting dollar.



For complete information on Imperial foundry belting send coupon on opposite side of this page

For More Information Circle 664, Page 39



"This intricate mold produced a casting that passed 100% X-ray tests...thanks to J-M Ris-A-Sleev."

Mickey Fratello, Owner,
Castwell Foundry Company, Inc., Middletown, New York

"By keeping the feed metal molten for 30 minutes, J-M Ris-A-Sleev permitted the thin and heavy walls on a 3,600-pound aluminum casting to be cast to an even density. What's more, we were able to save 1,800 pounds of metal because only 125 pounds were needed for the risers. In addition, Ris-A-Sleev saved us a great deal of time by minimizing the amount of metal that had to be cut and ground off the casting.

"We also find Ris-A-Sleev ideal for *magnesium* castings. We used these J-M risers on an intricate 1,200-pound magnesium casting and got perfect results. As a matter of fact, Ris-A-Sleev is the only riser used in our foundry."

For the full J-M Ris-A-Sleev® story, write to J. B. Jobe, Vice President, Johns-Manville, Box 14, New York 16, N. Y. In Canada: Port Credit, Ontario. Cable: Johnmanvil.

Here you see how J-M Ris-A-Sleev was positioned on this king-size mold to produce a sound casting.

JOHNS-MANVILLE JM

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SAND

Portage (Wis.) Silica
Century Molding
*Ottawa Blackhawk Silica
Muskegon Lake Sand
Tenn. & Ind. Molding
Utica Crude Silica
Green Lake & St. Marie Shell
*Zircon Sand and Flour
Berlin Core Sand
Red Flint Annealing & Packing
New Jersey Molding
Gallia Red Molding
Albany Molding
Olivine Sand and Flour
Gopher State Silica

BONDING CLAYS

*Volclay, MX-80 (Granular)
*and Panther Creek Bentonite
*Goose Lake Fire Clay
*Grundite Bonding Clay
Goose Lake Castables

ABRASIVES

*Rotoblast Steel Shot
Mallan'Steel Shot and Grit
Globite Steel Shot and Grit
*Mallebrasive Shot and Grit
*Certified Shot and Grit
*Blackhawk Sand Blast Sand
*Super-Titan Nozzles

REFRACTORIES & MISC.

Cupola Gun Mixes
Firegan Ganister
*Microsil Silica Flour
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606 Lake Drive
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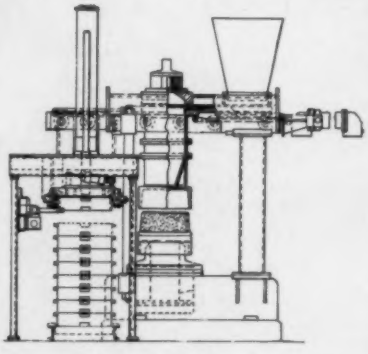
to burn off the wax coating and the volatile material in the slurry. *Patent No. 2,979,790 granted to I. J. Lubalin and assigned to Shaw Process Development Corp.*

Molding Machine

Through a combination of blowing and squeezing techniques, dense sand molds are obtained. Pattern on elevatable table is raised up to and sealed against a box forming part of the head of the blowing unit, and sand is blown in the box. Table is lowered, taking with it the sand compact. Blowing portion of the machine is moved away, and a flask under a squeezing ram



is moved into position over the sand compact on the table. Table and sand compact are moved upward, and the sand is squeezed into the flask against the ram. Table and pattern are moved down, leaving the sand in the flask. Flask and ram are moved out of the way, and the cycle repeated. *Patent No. 2,986,785 granted to L. F. Miller and E. K. Hatch and assigned to Osborn Mfg. Co.*

Core Binder

This core binding material is an alkali-metal phosphate-modified starch. It is prepared by impregnating an ungelatinized starch with at least 1 per cent by weight phosphorus by use of an alkali metal phosphate salt such as sodium, potassium, and lithium orthophosphates.

The liquid phase is removed, and starch is dried to a moisture content less than 15 per cent at a temperature below the gelatinization point. Then the dried starch is baked at a temperature between 265 and 325° F for 1 to 15 hours,

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Kozma Melting and Holding Furnaces are being specified by die casters, permanent molders and aluminum producers . . . where highest quality metal is a "must."

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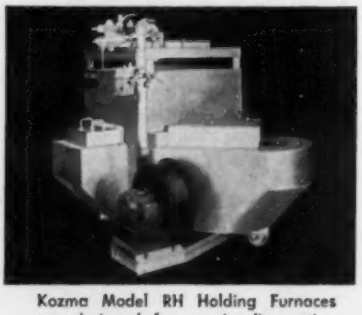
Kozma Tilt-Type Furnaces provide faster melting rate, highest possible metal purity, increased fuel economy, lower melting costs. Capacities from 600 to 2,000 lbs. per hour.

HOLDING FURNACE



Kozma Model RH Holding Furnaces are designed for use in die casting and permanent molding. Roller bearing wheels and a unique dipwell permit integral installation. Bath capacities and dipwells can be designed to meet your particular requirements.

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3471 WYOMING
DEARBORN, MICHIGAN
Industrial Processing Furnaces . . . since 1928

For More Information Circle 666, Page 39

For More Information Circle 667, Page 39

where carbon control counts...

count 5

and choose the ABC Foundry Coke that meets your particular cupola requirement. Only ABC produces *five* types of foundry coke: *One* type for highest carbon pick-up . . . *One* type for intermediate carbon pick-up . . . *Three* types for the lower carbon pick-up requirements of malleable iron and semi-steel foundries. Each type of ABC Foundry Coke is engineered for performance within close limits and is cupola-controlled at ABC's Coke Plant.

Do you have a carbon pick-up problem? An experienced ABC service engineer will gladly discuss your cupola melting and recommend the type of ABC Foundry Coke best suited to give you closer carbon control . . . control *that counts* in lower cost and better castings.

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ABC... 'Familiar Combination For The Finest in Foundry Coke'

For More Information Circle 668, Page 39

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AND THIS IS GRIT.
WE MAKE BOTH
IRON AND STEEL*.
QUALITY IS CONTROLLED
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THE MOST
"PERSUASIVE ABRASIVES"
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8560-CMA

the baking time varying inversely with the temperature. *Patent No.* 2,977,236 *granted to H. Neukom and assigned to International Minerals & Chemical Corp.*

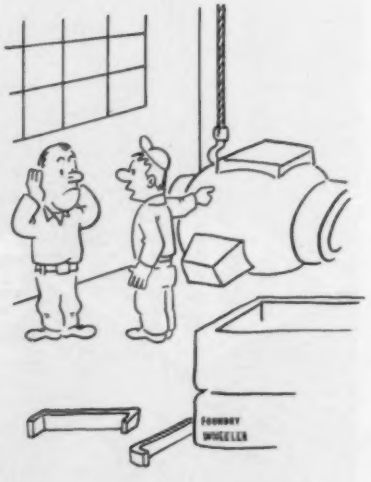
Shell Mold Binder

Bonding agent for making shell molds and cores consists of phenol formaldehyde resin treated with petroleum hydrocarbon-insoluble pine wood resin. The pine resin composition also may be treated with furfural prior to mixing it with the phenol resin. *Patent No.* 2,990,594 *granted to J. R. Lewis and assigned to Hercules Powder Co.*

Core Binder

Additive particularly for alkali metal phosphate-modified core binders is claimed to render baking time less critical, to extend the baking time at which peak strength is a maximum, and to increase the baked strength of the cores. Material is glutamic acid end liquor obtained in the recovery of glutamic acid from sugar beet waste liquor, and may have a pH of 3.2 or from 6 to 8.

The glutamic end liquor addition to the core mixture is from 0.25 to 0.50 per cent by weight of the total core, dry basis. *Patent No.* 2,988,453 *granted to F. A. Hoglan and J. W. Sietsema and assigned to International Minerals & Chemical Corp.*



"You'll have to admit that it would have been perfect if I hadn't put the core in backward"

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YOU CAN SEE THE RESULTS

Here's a TACCONE DUPLEX Hydra-Pneumatic System on test in our shops

Includes:

- Duplex Molder TDHP 36 - 48
- Rollover
- Mold Closer
- Elevator
- Punchout
- Flask Separator and Puller
- Indexer
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Every foundry can profit from automatic operation using a TACCONE Indexed-Inline Molding Process. It is the last word in continuous casting production. The heart of every TACCONE System is a Hydra-Pneumatic Molding Machine, with its thick compensating pad, the exclusive feature that makes high density molding a reality. It produces the cope and drag at the same time and is designed to cycle up to 300 molds per hour, depending on flask size. Consult with TACCONE Engineers for the type of automatic operation that is best for your foundry. For General Description of TACCONE System, write for Catalogue 100J.

Start your Automatic Foundry with a TACCONE Hydra-Pneumatic or Diaphragm Molding Machine.

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DESIGNERS AND MANUFACTURERS OF CUSTOM AUTOMATED FOUNDRY EQUIPMENT — LEADERS IN HIGH DENSITY MOLDING

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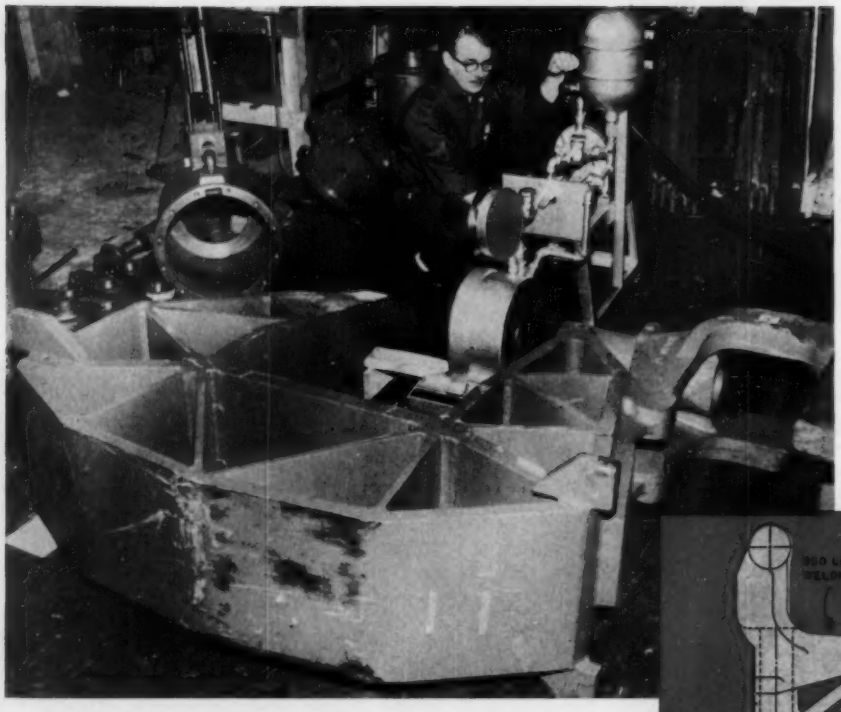
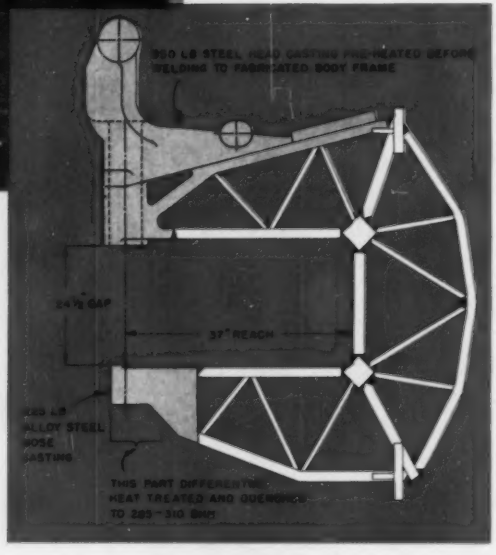


Showing the weldment-casting combination being tested under hydraulic pressure. Under 80-ton pressure, it deflects only 5/16 in.

Drawing outlines combination unit showing the two castings and welded sections now employed


350 LB STEEL HEAD CASTING PRE-HEATED BEFORE WELDING TO FABRICATED BODY FRAME
24½ GAP
37" REACH
225 LB ALLOY STEEL NOSE CASTING
THIS PART DIFFERENTIAL HEAT TREATED AND QUENCHED TO 285-310 BHN

Machine Designed to Combine

WELDMENT and CASTINGS

● FOR 58 years, Hanna Engineering Works, Chicago, has built large riveting machines used in the construction of many bridges, buildings, and oil-cracking units throughout the world. These machines operate with working pressures of 30 to 175 tons and more.

In the past, the riveters have been made of steel castings. Hanna engineers recently designed an 80-ton unit which combines a welded steel frame and two steel castings for the nose and head parts. The design is said to offer advantages not attainable if either a weldment or a single casting were to be used alone.

The frame structure, according to John Hanna, company president, is engineered on the old concept of sticks and strings; the sticks are those elements which tend to get shorter, the strings are those parts which tend to get longer under load.

The head and nose castings, made by the Falk Corp., Milwaukee, can be fitted to frames of various size riveters—an important advantage in providing design flexibility. The 225-lb nose casting, made of alloy steel, is under considerable strain on the riveter. Part of this piece is heat treated and quenched to 285-310 Brinell hardness, an operation which is facilitated by the use of this type of design instead of a single casting for the entire structure.

Other reported advantages of the design are a saving in manufacturing cost and improved delivery on custom orders.

The frame structure weighs 2250 lb and is fabricated from steel plate 16 in. wide and ¾, 1½, and 1¾ in. thick, with 4 x 4-in. bars for intersection blocks. The two castings and the frame areas onto which the castings are to be welded are preheated before welding, and the entire structure is stress relieved after fabrication.

"INGREDIENTS" MAKE THE DIFFERENCE

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The recipe for fire clay was written by Mother Nature. The ingredients are a naturally occurring blend of clay and silica. The proportion can range from 30% to 80% clay in the fire clay or refractory you buy. It all depends upon the effect of nature's elements during the last 100,000 years . . . of weather, wind and water.

Revivo gives you better results per dollar. That's because Revivo's uniformly high purity is recognized by all types of foundries . . . means easy sand control, better castings. Actually, there's no finer kaolinite. The typical Revivo as used by all types of foundries during the last 37 years is as follows:

Kaolinite (Al_2O_3. $2SiO_2$. $2H_2O$)	83.1%
Quartz (SiO_2)	10.7%
Rutile plus Leucoxene (TiO_2 plus TiO_2. nH_2O)	2.7%
Muscovite mica (K_2O. $3Al_2O_3$. $6SiO_2$. $2H_2O$)	1.8%
Iron pyrite (FeS_2)	0.1%
Limonite (Fe_2O_3, nH_2O)	0.4%
Ilmenite (FeO. TiO_2)	1.2%

Write or call your IMC full-line service engineer for more Revivo details and for an unbiased bond clay recommendation.

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FS-2-2

Gray iron foundry cuts casting reject rate from 11% to 3%

Line frequency induction superheater improves microstructure and uniformity of melt in critical production of automotive parts

Another major gray iron foundry has solved the problem of excessive rejects when casting to rigid specifications by duplexing with a Brown Boveri electric furnace. Using a 12-ton capacity, 1000 kv induction furnace for superheating 20 tons of gray iron an hour, this foundry (we'll send you their name and installation details on request) now produces metal with better microstructure and near-perfect balance between tensile strength and Brinell hardness. The uniformity of their high-quality thin-wall castings is reflected in substantial metal savings and in the reduction of the reject rate from 11% to a low 3%.

Here's how this single piece of equipment can improve the production output – and the profit picture – of a gray iron foundry. The electric furnace, alone or duplexed with arc furnace or cupola, provides the otherwise missing requirements for quality output: extra-high temperature and precision control for reproduction consistency. Since its heat is generated by induction, local over-heating is eliminated. The stirring effect produces a well-mixed homoggenous melt. And charge after charge is easily and accurately held to identical temperature and make-up, even where demand is irregular and the pouring intermittent.

Find out how these units, available in 1 to 33 ton capacities and suited to even the most automated melting, holding and casting systems, can let you lower your reject rate . . . while raising your profits. If you melt and cast gray iron – or aluminum, for this electric furnace is equally effective in aluminum operations – you'll want to talk to your nearest Brown Boveri representative. Or write us for more information. Dept. **F-10,** Brown Boveri Corp., 19 Rector Street, New York 6, N. Y.

Brown Boveri offers a full range of line, medium and high frequency coreless and core-type induction furnaces; arc furnaces, resistance furnaces and complete accessories for a perfect mating of equipment to every operating condition and application. When you call on Brown Boveri, you're assured the benefit of 70 years' experience in electrical and mechanical power equipment plus one of the world's most extensive research and development programs in electrics and metallurgy. Full unit responsibility and precise co-ordination of every installation is guaranteed.

BROWN BOVERI

For More Information Circle 672, Page 39

Technical Reports at

International Foundry Congress

Concluding reports on technical papers presented at the recent Congress in Vienna cover such subjects as cupola melting, gating, molding sands, gases in cast metals, solidification influence, permanent mold castings, and quality tests

By M. M. HALLETT
Managing Director
Chamberlin & Hill Ltd., Walsall, England
European Editor, Foundry

● PAPERS dealt with in this report of the International Foundry Congress technical papers cover a variety of subjects. They include cupola melting, running and gating, molding sands, various aspects of gases in cast metals, structure as influenced by the mode of solidification, permanent mold castings, statistics and quality.

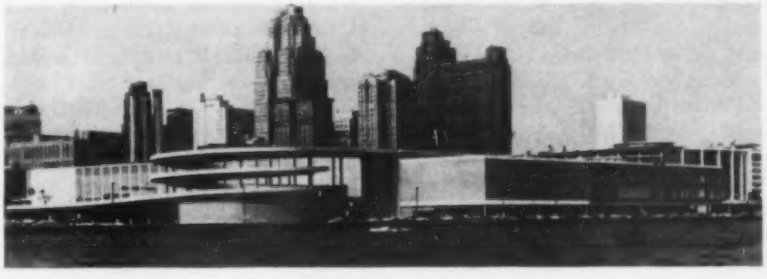
Cold Blast Cupola—A long paper on the materials balance and the thermal balance of a cold blast cupola was given by W. Patterson, H. Siepmann, and H. Pacyna (Germany, written in German), the results being presented in 37 figures. The experiments were carried out in a 30-in.-diam cupola at coke charges of 10-16 per cent and a wide range of blast volumes, some 25 variables being recorded.

The calculated differences between heat generated and heat used lay within ±1 per cent. Such small factors as the heat content of the exhaust dust, increase of air temperature in the blower, and combustion of hydrogen in the coke were covered. Generally, during the first hour of operation the heat losses are much higher and the coke bed burns down, but during the second hour the bed builds up from the coke splits, the furnace warms up properly, the blast volume increases, and reasonably steady running follows.

It is, therefore, necessary for any experiment to last beyond two hours to secure reproducible results. The radiation losses over-all amounted to about 6.5 per cent of the heat supplied. The iron temperature at first tap was about 2740° F; it then dropped to 2575° after 1½ hours and recovered steadily to a second maximum of 2660° F after 4½ hours running.

Cupola Malleable—J. Guillamon and F. Lutz (France and Austria, written in German) described a modified cupola furnace suitable for melting iron for blackheart and whiteheart malleable castings. The normal cupola cannot melt iron with about 2.6 per cent carbon and 1.2 per cent silicon at a high enough temperature to run good castings, but this can readily be done in the new cupola working with an all-scrap charge and coke charges at 13-14 per cent while keeping carbon within ±0.1 per cent and silicon within ±0.12 per cent.

The cupola is sealed to a forehearth and molten iron is delivered through a flat channel to the forehearth. Slag is withdrawn continuously from the forehearth and passes into a water granulator. Part of the air blast passes downwards from the tuyeres, over the cupola bottom, along the communicating channel and out over the slag granulator and through a water cooler.



DETROIT IS NEXT: The International Foundry Congress returns to the United States next spring for the first time since 1952. To be held in conjunction with the 66th Castings Congress and Exposition of the American Foundrymen's Society, it is expected to attract a large attendance from foreign countries. Site of the two events will be Detroit's new and spacious Cobo Hall (above)

In its passage the gas superheats the bottom and the channel with the iron flowing in it. The main control is effected by the air blast volume and the height of the tuyeres above the cupola bottom, but considerable extra control comes from alteration in the amount of hot gas passed out through the forehearth.

Metal Flow—A paper on the flow of molten metal through the gating system in relation to the uniformity of mold filling was presented by A. Kalman (Hungary, written in German). This embraced theoret-

ical calculations based on Bernouill's equation and experimental work.

It appeared that the hydrodynamic characteristics of waterflow were applicable to molten iron. Both the practical and the theoretical work showed that when a number of identical ingates were distributed along a common runner, the pressure and the rate of metal flow were highest in the gates farthest from the sprue and lowest in those close to the sprue, these differences being more marked when there were more than five gates.

The uniformity of flow through the gates was better the greater was the ratio of the cross-sectional area of the runner to the total cross-sectional area of the ingates and was also better when there was considerable back pressure from the gases in the mold or from great length or high resistance to flow in the runner.

Sand Flowability—The flowability of molding sands was studied by J. M. Navarro and J. Navarro-Alcacer (Spain, written in English). They defined flowability as the ability of a sand to flow into a distant recess into which it could not be rammed directly and to retain in the recess a specific strength which would suffice for making a good mold surface. The experimental equipment involved a small sand test piece placed separately in a recess which was compressed by transmission of pressure through other sand under standard conditions.

After this treatment the hardness of the test piece was measured at different depths to determine at what depth it retained a mold hardness of 65. Moisture content was found to be the most important variable, mixtures reaching maximum properties at definite moisture contents which depended on the amount and type of binder. Increasing bentonite contents increased penetration, and coarse sands were superior to fine sands. Grain size distribution was of no importance.

At low moisture contents calcium bentonites were better than sodium bentonites, but at high moisture this was reversed. Coal dust increased penetration but dextrin decreased it. It was found that contouring the lead into a recess gave worse results than with a right-angle recess, apparently because in the latter case a complete block of sand moved into the recess whereas in the shaped lead in, different blocks of sand mutually compressed each other, interfering with smooth forward flow.

Sodium Silicate Binder—A paper by A. M. Liass (U.S.S.R., written in German) on sodium silicate bonded molding sands included both a theoretical and a practical portion. In the first part the structure and constitution of the bond was studied and it was concluded that the bond consisted of dense spheroidal particles of polysilicates arranged in clusters with a diameter of 70-85 Angstrom units. Dehydration, however applied, led to the formation of a glassy sodium silicate film of high strength.

By choice of silicate, coupled with the introduction of caustic soda solution, control of mixing conditions, etc., it was possible to produce molds and cores with desired combinations of properties. Some details were given of large steel castings weighing up to 70 tons, such as for hydroelectric plant, made by the CO_2 process in which higher accuracy of castings had led to substantial savings in machining. At the same time, foundry productivity was increased by one-third. Some of these castings were made with silicate-bonded shell molds and shell cores at diameters up to nearly 10 ft. Castings made in shells were much less liable to formation of internal stresses during cooling.

"When I said, 'Feed the riser,' he threw his lunch in"

Gas Evolution—A mainly theoretical paper on gas evolution from cores during the casting operation was given by J. Ornst (Czechoslovakia, written in German). Gas evolution passed through two maxima, the first one being considerably the larger. It was clear that this maximum corresponded to the point where the core was completely submerged under the molten metal, the gas arising from the burning of the core binders at the surface of the core.

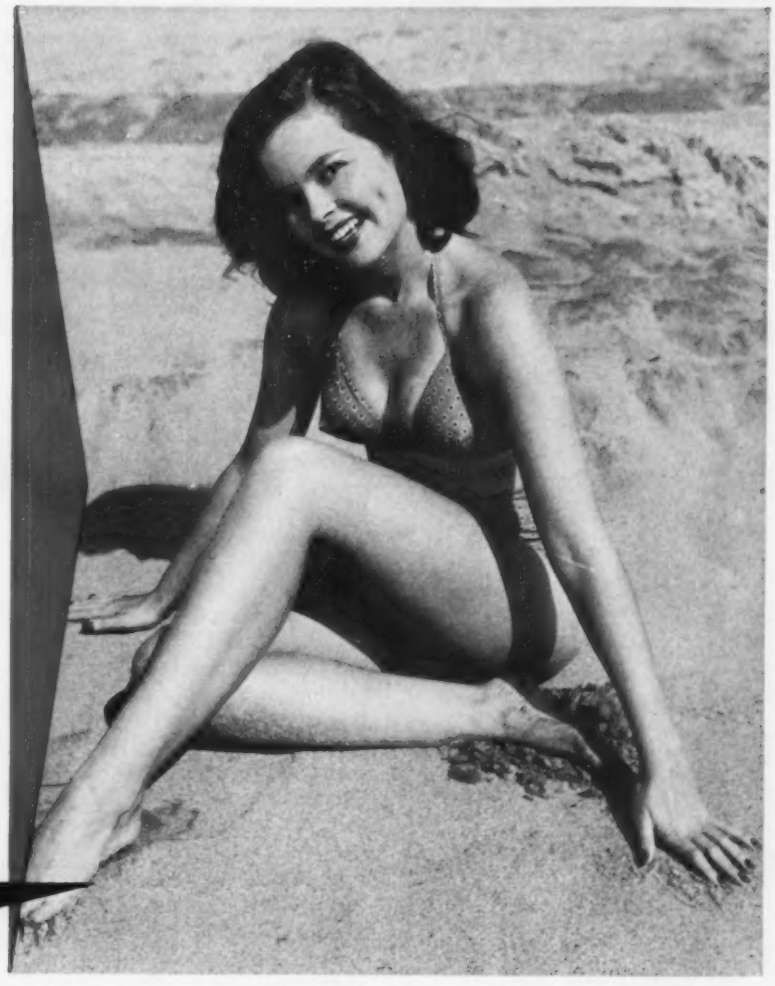
The evolution at this moment obviously was dependent on the core surface area much more than on the core volume and led to a method of determining the maximum rate of gas evolution per unit surface area at a specified temperature. The tendency of this maximum rate to give rise to blow holes in the casting was defined by a coefficient of ebullition. With this coefficient could be calculated the details of the binders, desired permeability, amount of venting, height of the core prints, etc. Two nomograms were included in the paper; these have been found satisfactory under practical conditions though they may need some eventual modification.

Blow Holes—Another point of view on gas evolution in relation to blow holes was presented by K. Suzuki and H. Yamaoko (Japan, written in English). They measured the gas pressure existing just under the mold surface and found it almost invariably much lower than the metallostatic pressure so that gas would not enter the molten metal. Only at a point just below the level of the rising molten metal was the metallostatic pressure low enough to permit entry of gas from the mold.

From this concept was developed a process to prevent gas entry below the molten metal surface. A neutral gas was caused to flow from the space above the molten metal through the mold (i.e. counter-current to the path of gas evolved from the mold) either by increasing the pressure in the space or by applying suction to the far side of the mold.

These steps effectively lowered the pressure of evolved mold gas and eliminated gas blow holes in

Makes a Good Impression with Sand



Smith L-O Core Oil

Compatible as Smith L-O is with sand, we recognize that there are always certain conditions that require specialized attention. We suggest, therefore, that you call in a Smith Foundry Service Man — a person of broad, "shirt-sleeve" experience — who will study your conditions and come up with a sound recommendation on the grade of Smith L-O you should use. Take advantage of this valuable assistance, for his help is further proof that Smith L-O *stands also for a service as well as a product.*

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a 6 molder foundry can have mulled overhead sand at lowest cost with a

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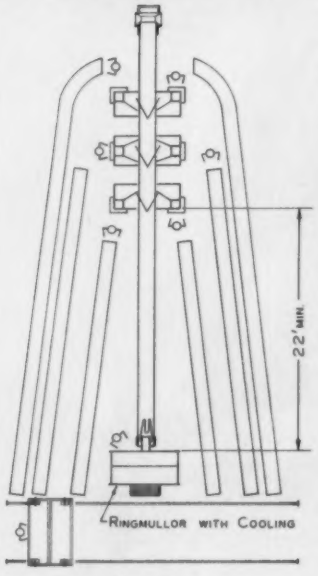
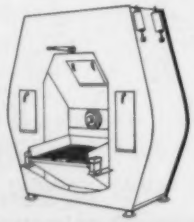


MELTING

Molds are dumped directly on Ringmullor screen, which conveys sand to batcher where it is cooled before mulling. An inclined belt returns cooled, mulled, aerated sand to overhead molder hoppers.

The Ringmullor may be stationary, as shown, or may be monorail mounted, wheel mounted, or moved by overhead crane. Consult us for other arrangements serving from 2 to 12 molders.



The RINGMULLOR is a completely self-contained sand plant that has everything: cooling, screening, batching, mulling, aeration, optional magnetic separation. Loads at bottom, discharges at top; no elevator or skip-hoist needed. Send for Bulletin M161.

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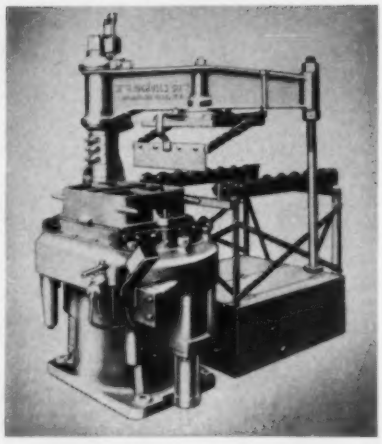
For More Information Circle 674, Page 39

the casting. The method needed a reasonably permeable mold and had no effect on blow holes caused by reactions within the molten metal. It permitted cheap green sand molds to be used in cases for which dry sand molds formerly were essential and resulted in good shell molded castings of low-carbon and 13 per cent chromium stainless steel.

Metal Treatment—The application of gas blowing and injection processes in the foundry was considered by E. K. Modl (Switzerland, written in German). The first half of the paper gave a review of the published work on the processes while the concluding portion provided details of practice in the author's foundry. This included desulfurization of gray iron by injection of calcium carbide, upgrading of gray iron by rare earth metal injections, inoculation of gray iron, treatment of aluminum bronzes, desulfurization of steel by calcium carbide injection and particularly various combinations of injection treatments of gray iron and spheroidal graphite iron to render these various alloys specially suitable for production of thin-walled castings.

Aluminum Nucleation—C. Mascre, A. Touguet and M. Drouzy (France, written in French) described work on the nucleation of aluminum using the "granule" method. This method involved the initial preparation of granules of exactly known size which were then cemented together by some type of clay to form a small ball which was attached to the hot junction of a thermocouple. The assembly was alternately heated and cooled at controlled speeds and thermal analyses taken during the melting and solidification processes.

By this means the effect of various nuclei on the degree of supercooling could be determined independently of any grain size effects. With pure aluminum the most important nuclei were distributed over the surface in numbers which increased rapidly with increasing supercooling. Additions of copper, zinc, iron, and silicon had no effect, but even 0.005 per cent titanium produced numerous active nuclei. These nuclei could be neutralized by superheating but reformed on solidification. In the aluminum



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For More Information Circle 675, Page 39

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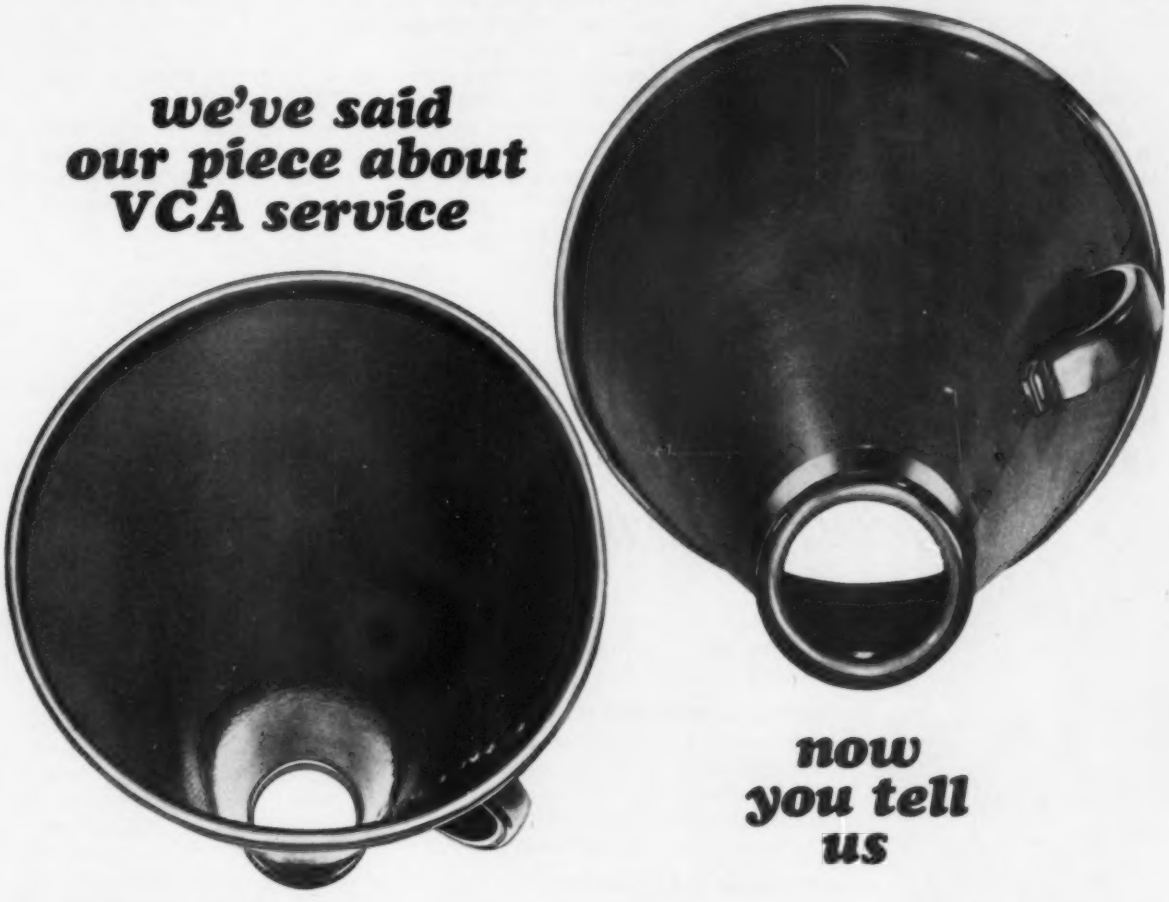

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VCA "SERVICE COMES FIRST" CONTEST

You've seen the ads. You've read the story of VCA's "extra-value-through-extra-service" policy. You're aware of the importance to the industry and to your company of VCA's fully integrated operation, R&D program, complete product line, strategically located plants, and all the other things we've discussed. But there's one thing the ads couldn't cover ...how VCA Service has helped you specifically. So, we're running a contest... a contest to get you to tell us.

Who Can Enter. The VCA "SERVICE COMES FIRST" CONTEST is open to anyone who has benefited from VCA service... researchers, PA's, production men, engineers, melters, even presidents.

How To Enter. Simply write a letter describing how VCA SERVICE has at some time or other helped you or your company solve a problem, cut costs, do a better job or make a better product. Tell us how, why, when, where, and for whom. Letters may be handwritten or typed, and may be of any reasonable length. Sketches, photographs or other supporting evidence may be included.

Prizes.

1st. FIVE — $100 U. S. Gov. Bonds, Series E
2nd. FIVE — $50 U. S. Gov. Bonds, Series E
3rd. FIVE — $25 U. S. Gov. Bonds, Series E

Additional Prizes.

4th. $100 U. S. Gov. Bond, Series E
5th. $50 U. S. Gov. Bond, Series E
6th. $25 U. S. Gov. Bond, Series E
7th. $25 U. S. Gov. Bond, Series E
8th. $25 U. S. Gov. Bond, Series E
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Bonus Prizes.
100 Stainless Pens for first 100 letters received. In the case of a tie, judges will award duplicate prizes.

Judges. The VCA "SERVICE COMES FIRST" CONTEST will be judged by a distinguished panel chosen from editorial, university, association and industry sources. Names will be announced at a later date.

Get More Information at the METALS SHOW. "SERVICE COMES FIRST" will be the theme of VCA's booth at the Metals Show. For more information about the contest, visit VCA Booth No. 338 at the show, being held this year in Detroit, Mich., October 23-27.

Closing Date. Entries must be mailed to VCA "SERVICE COMES FIRST" CONTEST
Vanadium Corporation of America
420 Lexington Ave., New York 17, N. Y.
and postmarked no later than November 20, 1961. Entries become the property of VCA and cannot be returned.

Winners will be announced on December 20, 1961. Bonds will be registered in the winners' names and forwarded immediately.

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For More Information Circle 676, Page 39

silicon alloy, phosphorus behaved like titanium in pure aluminum. Nuclei generally refined the grain of solid solution alloys but not of eutectics. They had little effect on dendritic dimensions.

Solidification—In a very short paper, I. Minkoff (Israel, written in English) discussed the solidification of eutectics. After reviewing the literature, some experiments were described on the solidification of aluminum silicon eutectics both at normal speed and at higher speed caused by chilling from one end. The phases in the microstructure subsequently were extracted by special deep etching. It was concluded that with increasing speed of solidification, the silicon phase changes from a plate form to a branched dendritic form in a continuous network. Branching and dendritic growth appeared to provide an adequate explanation for refinement of abnormal eutectics without reference to any concepts of nucleation and growth.

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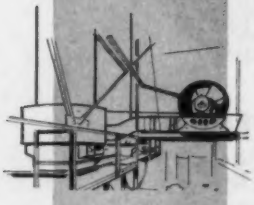

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By far the first choice of cupola manufacturers . . . and for replacement. Rugged, reliable units in a full range of capacities from ⅓ to 1,000 H.P.; up to 20,000 C.F.M.; 4 oz. to 10 lbs. pressure.

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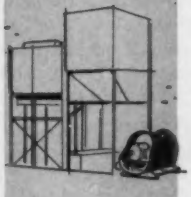

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Metal Observation—R. Mitsche, F. Gabler, W. Wurz and M. Brandstatter-Kuhnert (Austria, written in German) described apparatus which permitted the direct microscopic observation of the surface of liquid metal during melting and solidification at temperatures as high as 3270° F.

A small specimen was mounted in a sealed chamber and heated by molybdenum or tantalum strip. The chamber could be evacuated or filled with any desired gas. The objective of the microscope was underneath the metal specimen, but this was prevented from dropping, when molten, onto the objective by its surface tension.

Films could be taken during a heating and cooling cycle and the paper included a series of shots taken during melting and subsequent solidification of the same area on the surface of a specimen in spheroidal graphite iron. Such direct observations could be supplemented by studies on formation of structure in transparent organic compounds, drawing analogies between these and the solidification of metals.

Permanent Mold Castings—Austrian experience with low-pressure permanent mold casting was described by I. Berger (Austria, written in German). This process involves the use of low-pressure air to lift the molten light alloy up a heated tube into the bottom of the permanent mold. The metal rises in the mold without turbulence and solidifies directionally from the top of the mold to the bottom.

The process has been known for 50 years and the paper reviewed developments during this period in England, Germany and U.S.A. Austrian experience in the last 10 years showed that the process worked well and produced aluminum magnesium and aluminum silicon alloy castings of more complicated shape than previously thought possible. These included covers and housings for automotive and aircraft engines. The casting yield was very high. The machines could be manually operated with rack and pinion, or hydraulically, or fully automatically, and shell or other types of cores could be incorporated.

Experiences in the application of statistical methods to foundry

For More Information Circle 677, Page 39

Circle 678, Page 39→

"P-L-E-A-S-E, Dear Koppers..."

That guy Satan is a persistent devil all right. He's called a dozen times begging to buy some of our Koppers Premium Foundry Coke. It's kinda hard to keep saying no, because *he* says business is good down there and he wants to place a big order.

But business is good up here, too. Apparently the word has been getting around that Koppers Foundry Coke keeps operating costs way down and maintains a higher temperature range.

The reasons are these: Koppers Coke is prepared from the best quality West Virginia coals, carefully blended and baked the right length of time. It's absolutely uniform in *size*, *strength*, *structure* and *chemical analysis*. We check each day's run to be sure.

And because of its superior physical qualities, high carbon and low ash, Koppers Coke enables foundrymen to maintain higher temperatures which increases the cleanliness of the iron and helps to reduce fuel consumption.

No, we're still not going to sell Brother Satan—but we'd sure like to sell you. Why not make your next order Koppers Premium Foundry Coke? Available anywhere in the U.S. or Canada, it's sized to fit your needs. Koppers Company, Inc., Pittsburgh, Pennsylvania.

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MIXALL gives AUTO SPECIALTIES Mfg. Co. up to 6,000 lbs. of Coated Sand per hour— at **lower costs than ever before!**

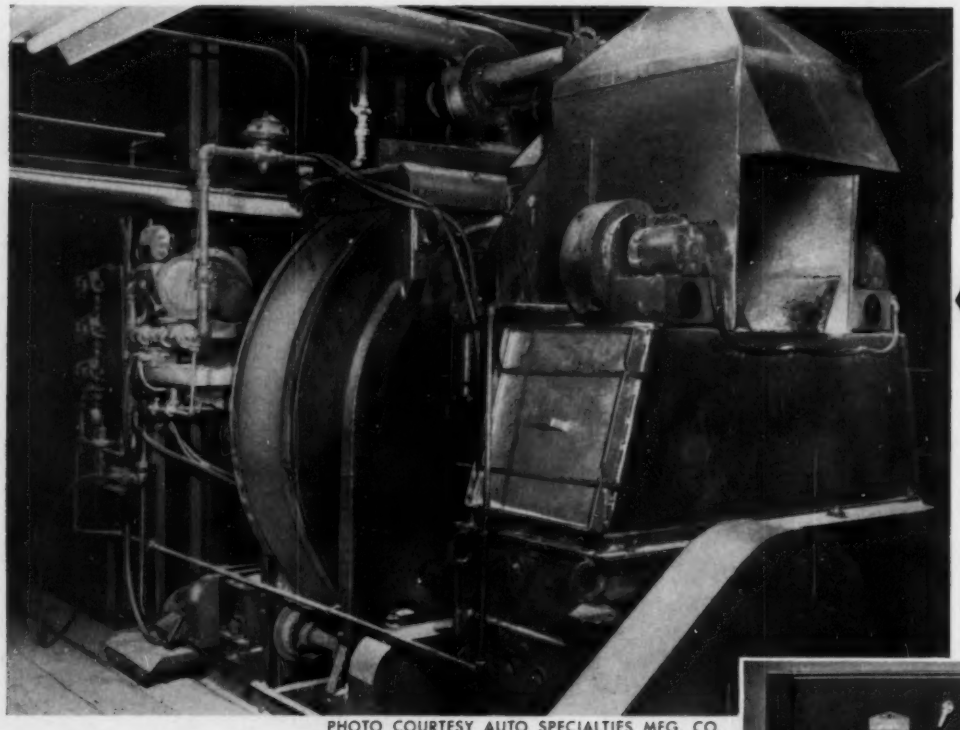
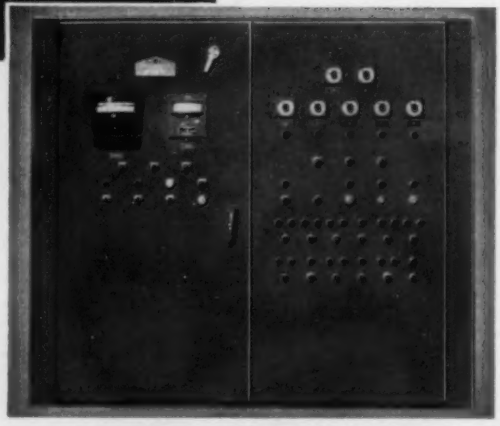


PHOTO COURTESY AUTO SPECIALTIES MFG. CO.

At left, the new MIXALL in operation at Auto Specialties Mfg. Co., St. Joseph, Michigan

Other Models from 3000 lbs. per hour up to 20,000 lbs. per hour available

In the production of castings for the automotive industry, Auto Specialties Manufacturing Co. has found that the MIXALL delivers greater batch capacity to meet its growing needs while keeping production costs down. This is accomplished by a rapid operating cycle: charging, heating, mixing, and discharging are completed in just *4 minutes.* Simultaneous heating and mixing are possible because both cycles are independently controlled. To meet today's growing competition, this kind of practical mechanization is often the solution. Perhaps your organization can profit from the many advantages offered by the MIXALL. Our experienced engineers will be happy to discuss *your* foundry problems and put you on the road to practical mechanization at the lowest cost possible. Write, call or wire.



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For More Information Circle 679, Page 39

studies were the basis of a paper by G. Blanc and J. C. Margerie (France, written in French). The foundry industry, in which results are determined by a multiplicity of factors difficult to separate, was considered to be a good field for the application of statistical methods.

After considering the fundamentals regarding deviation and distribution of results, it was pointed out that much more fruitful results could be obtained if an investigation was planned from the beginning for statistical treatment. Examples mentioned of laboratory studies included a comparison of analyses obtained in different laboratories, segregation and distribution problems and effects of treatments on mechanical properties of castings.

In the foundry itself, statistical techniques in an investigation on hot blast cupolas showed clearly that blast volume was much the most important factor, followed in order by coke ratio and blast temperature, with tuyere diameter having no effect. Reduction of scrap and quality control were suitable for study with the aid of control and index cards which could readily be used by the foundry staff.

Casting Quality — A. Karamara (Poland, written in German) in a paper on new criteria for determining the quality of castings discussed the value of conventional tests such as tensile strength and hardness and the difficulty of correlating results on test pieces with those on the castings themselves. In the case of gray iron, the slope of the tensile stress-strain curve at various points and the amount of permanent deformation at specified stresses, or the stresses needed to produce a specified permanent deformation, seemed to be valid quality indicators which were liable to less scatter of value than tensile strength itself.

Variation in Poisson's ratio with applied stress was another interesting field for study. It was found that irons which had similar magnetic properties (permeability, remanence, coercive force, saturation value, etc.) also had similar deformation characteristics and other mechanical properties, thus opening up possibilities for nondestructive testing. Similar techniques could be applied to cast brass and bronze.

THE BIG SWITCH IS TO ACME RESIN

Clarence Humphrey, foundry foreman, and Bill Clark, foundry superintendent of Clinton Engines Corp., Maquoketa, Iowa, admire one of the shell molds which will produce the air-cooled cylinder for famous Clinton Engines. Mr. Clark says:

"Since switching to Acme Resin in February, 1961, we have increased our production and reduced our scrap considerably. Our casting finish and quality have also improved.

"The uniformity of the resin from truckload to truckload has made it easy for us to control our coating. Since coating our sand with Acme Resin, the problems of caking in the hoppers, peel back and veining have been eliminated."

Because Acme depends on the Foundry Industry for a major part of its phenolic resin business, much of its research is concentrated on the development of new and better resins for foundries.

In addition, Acme's representatives are practical foundry men who know the difference between a cope and a drag, and can help to prevent or cure molding problems. They would welcome the opportunity to be of service to you.

ACME RESIN ALSO PRODUCES

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OBITUARY

Edmund E. Allyne, 86, one-time prominent foundryman, died Aug. 18. He established several companies, including Allyne Bros. Foundry Co., Aluminum Castings Co., and Allyne-Ryan Foundry Co., all of Cleveland. In later years he developed an automotive lubrication system and a refrigeration unit.

Grover C. (Jack) Cole, retired consultant, Grede Foundries Inc., Milwaukee, died Aug. 21. He had been in the foundry industry nearly 40 years, and his previous connections included Wysong & Miles Foundry Inc., Greensboro, N. C., and Forest City Foundries Co., Cleveland.

Walter DeBarr, 85, retired superintendent, Miami Foundry, Miamisburg, Ohio, died Aug. 18.

Jeanette Holtan, 84, treasurer, Slinger Foundry Co., Slinger, Wis., died Aug. 11. She had been treasurer of the foundry since 1948. The foundry is operated by her sons.

Edward G. Diebel, 60, foundry superintendent, Lattimer Stevens Co., Columbus, Ohio, died Aug 21.

Henry W. Longfield, 89, retired superintendent of the former Ohio Foundry Co., Cleveland, died Aug. 8.

Carl J. Kuhn, metallurgist, Sawbrook Steel Castings Co., Cincinnati, died recently.

Victor H. Bohl, 63, general superintendent, Kirsh Foundry, Beaver Dam, Wis., died Sept. 1.

Perry A. McArthur, for the last 23 years sales representative of the S. Obermayer Co., Chicago, died Sept. 3.

Stephen E. Kelly, 63, metallurgical sales engineer, Canton Malleable Iron Co., Canton, Ohio, died Aug. 30. Previous to the last four years he was with Eberhard Mfg. Co., division of the Eastern Co., Cleveland. Mr. Kelly was chairman of the Northeastern Ohio Chapter, AFS, in 1953-54.

Fred J. Velpel, 85, retired foreman, Auburn Foundry, Auburn, Ind., died Aug. 25.

William L. Garner, 72, sales engineer, Exomet Inc., Conneaut, Ohio, died Aug. 28. He had been with the company for 11 years.

Paul Bechtner, 79, board chairman, American Colloid Co., Skokie, Ill., died Sept. 4. He founded the company in 1927.

Charles C. Gates, 84, president, Gates Rubber Co., Denver, died Aug. 29. He had been president since the company's founding in 1911.

William K. Sproule, 48, died Aug. 8. He had been consulting engineer, Development & Research Div., International Nickel Co., New York, since 1956.

Paul A. Schmidt, 44, Cleveland district sales manager, U. S. Pipe & Foundry Co., died Aug. 18.

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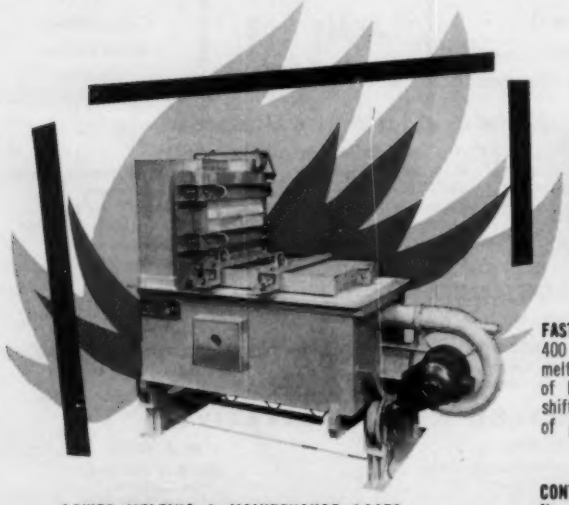
USING REDA GAS-OIL FIRED FURNACES!



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FASTER MELTING — One 400 series Reda Furnace melts up to 11,000 lbs. of brass or bronze per shift, and up to 6,000 lbs. of gray iron per shift.

LOWER MELTING & MAINTENANCE COSTS — One man can operate a Reda Furnace . . . No daily repairs needed!

CONTINUOUS POURING — No waiting until floors, flasks, boards, etc. are filled with molds!

FURNACE DIVISION — WRITE TODAY FOR DESCRIPTIVE BULLETIN
REDA PUMP COMPANY - BARTLESVILLE, OKLAHOMA

Offers Revised Standard Tables For Metal Hardness Conversion

Newly revised American Standard hardness conversion tables for metals specify the relationship between Brinell hardness, diamond pyramid hardness, Rockwell hardness, and Rockwell superficial hardness of carbon, alloy, and tool steels, nickel and high-nickel alloys, and cartridge brass. Developed and published by the American Society for Testing and Materials, "American Standard Hardness Conversion Tables for Metals (ASTM E140-58) Z76.4-1961" replaces American Standards Z76.1-1955, Z76.2-1955, and Z76.3-1955. Six hardness conversion tables accompany the text of the publication.

Copies are available at 30 cents each from the American Standards Association, Dept. P245, 10 E. 40th St., New York 16, N. Y., or the American Society for Testing and Materials, 1916 Race St., Philadelphia 3, Pa.

Let Soffel's RED DEVIL THERMOTOMIC HoTop

Reduce Your HEAD SIZE SAVE TIME and MONEY

Ask Your Soffel's Distributor for A DEMONSTRATION

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Pacific Graphite Co.
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Atlas Foundry Service Co.
P. O. Box 832,
1055 E. First St.

COLO., DENVER
Kramer Industrial Supply, Inc.
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Midwest Foundry Supply Co.
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Gene Conreaux & Co.
3637 Farnsworth Ave.
P. O. Box 41004

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Vince Bruce, Inc.
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Frederic B. Stevens, Inc.
1800 18th Street

MINN., MINNEAPOLIS 14
Foundry Supply Co.
650 25th Ave., S.E.

NEW YORK, BUFFALO 11
Frederic B. Stevens, Inc.
597 Northland Avenue

ORE., PORTLAND 7
LaGrand Industrial Supply Co.
P. O. Box 8053

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Robert G. Dyer
114 Dolly Lane
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TEXAS, HOUSTON 21
Brandt Equipment & Supply Co.
6620 Dixie Drive,
P. O. Box 14284

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45 So. 3rd West

WASH., SEATTLE 4
Carl F. Miller and Co.
2450 Sixth Ave. S.

WISC., MILWAUKEE 19
Milwaukee Chaplet & Supply Corp.
8656 W. National Avenue

CANADA:

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Canadian Hanson & Van Winkle Co.
Silver and Morrow Avenues

Reduce the size of your heads and let Soffel's Red Devil Thermotomic Hotop keep that reduced amount of metal in the heads liquid so you will gain *more* sound, shrink-free castings from every ladle of metal poured.

Soffel's Red Devil Thermotomic Hotop will *not* contaminate any non-ferrous alloy, is *not* premium priced, requires *no* special engineering personnel, definitely *will* reduce costs and increase yield. Ask your nearest Soffel's Distributor for demonstration today.

Pittsburgh Metals Purifying Co.

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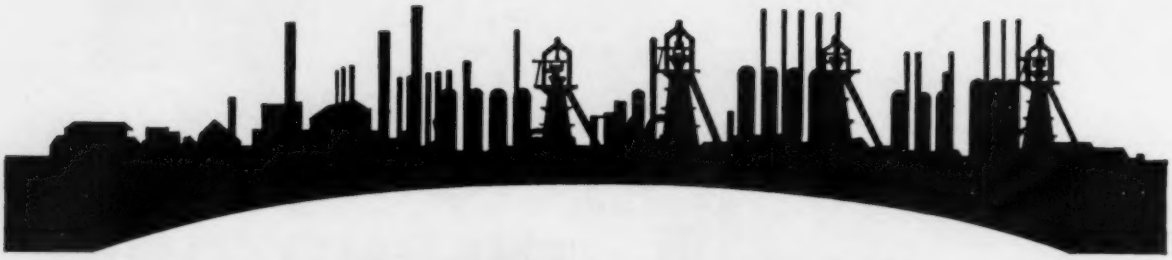
For More Information Circle 682, Page 39



Woodward Iron Grades Are Flexible and Diversified

Flexibility and diversity of Woodward iron grades is widely known throughout the foundry industry. This table shows:

Woodward Pig Iron — Typical Grades

GRADE	SILICON	SULFUR	PHOSPHORUS	MANGANESE
Basic	Up to 1.50% (as ordered)	0.05% Max.	0.10-0.30 or 0.30-0.70 or 0.70-0.80% (as ordered)	0.40-2.00% (as ordered)
Malleable	1.00 to 3.50% (as ordered)	0.05% Max.	0.10-0.30%	0.20-2.00% (as ordered)
Foundry	1.00 to 3.50% (as ordered)	0.05% Max.	0.301-0.70% (as ordered)	0.20-1.50% (as ordered)
Foundry (High Phos.)	0.75 to 3.50% (as ordered)	0.05% Max.	0.70-0.90% Up to 1.50% (as ordered)	0.20-1.50% (as ordered)

Woodward also produces irons for operations requiring special analyses due to their particular application to out-of-the-ordinary types of casting. Whatever type of quality iron your company requires, you can be sure that Woodward can meet your specifications.

For quotations, write or call our Sales Department, Woodward, Ala.

Phone Bessemer, Ala. HAmilton 5-2491

or Sales Agents for Territory north of Ohio River:

HICKMAN, WILLIAMS & COMPANY, 230 North Michigan Ave., Chicago 1, Ill.

Offices in Principal Cities

WOODWARD IRON COMPANY

WOODWARD IRON COMPANY

WOODWARD, ALABAMA

Independent Since 1882

MEN of INDUSTRY

J. J. DAVIS
. . . Esco president

KENNETH W. RHOADS

DAVID W. BOYD

. . . officers at Engineering Castings

JOHN E. McINTYRE
. . . Sibley president

LEON F. CORP
. . . GMC veteran

J. J. Davis, formerly executive vice president, has been elected president, Esco Corp., Portland, Oreg., succeeding **Newman Ward,** who becomes chairman of the board of directors. **C. F. Swigert Jr.** has been elected honorary chairman.

Kenneth W. Rhoads, formerly secretary-treasurer and purchasing agent, Engineering Castings Inc., Marshall, Mich., has been elected chairman of the board and chief executive officer and also will continue as treasurer. He succeeds **Albert E. Rhoads,** president and chief executive officer since the company was founded in 1946, who remains on the board of directors and will continue in a consulting and advisory capacity. **David W. Boyd,** formerly executive vice president, has been elected president and becomes chief administrative officer.

Alfred F. Bauer has been appointed manager, Doehler-Jarvis Div., National Lead Co., New York. With Doehler-Jarvis since 1951, he has directed the company's research and development program.

Charles H. Meister, Jardine Bronze Foundry Inc., Baldwinsville, N. Y., has been appointed to the Administrative Council of the National Foundry Association. He replaces **William W. Thomas,** Straight Line Foundry & Machine Co., Syracuse, N. Y., who resigned when his firm ceased operations.

John E. McIntyre has been elected president, Sibley Machine & Foundry Corp., South Bend, Ind. He joined the company in 1931, and since 1945 has been vice president and general manager. He succeeds **Bernard J. Voll,** president the last 39 years, who becomes board chairman. **William H. Voll,** formerly sales manager, has been made vice president in charge of sales, and **Philip G. Hahl,** former controller, has been elected secretary.

Charles A. Myers has been advanced from sales manager to vice president in charge of sales, Belle City Malleable Iron Co. and Racine Steel Castings Co., Racine, Wis.

John Varga Jr. has joined Precision Castparts Corp., Portland, Oreg., as chief engineer. He was formerly project leader in process metallurgy research at Battelle Memorial Institute, Columbus, Ohio.

John L. Campbell has been named sales manager, Stainless Foundry & Engineering Inc., Milwaukee. He formerly was with National Carbon Div., Union Carbide Corp., Chicago.

Philip H. Snyder has been appointed plant manager, Alloy Division, Beryllium Corp., Reading, Pa. Since last April Mr. Snyder was production manager of the company's nuclear division fabrication plant.

Leon F. Corp, assistant manufacturing manager, Central Foundry Div., General Motors Corp., Saginaw, Mich., has retired. With the company for over 35 years, Mr. Corp also had been assistant divisional manufacturing manager.

Philip S. Hill has been named president, Hyster Co., Portland, Oreg., succeeding **Earnest G. Swigert.** Mr. Swigert was appointed chairman of the board of directors and chief executive officer of the company. **Harvey N. Black,** previously vice president, has been appointed senior vice president and also continues as secretary and treasurer.

A. E. Field has been made a vice president, National Castings Co., Cleveland. He will continue as secretary, a position he has held since 1946.

Joseph C. Carey has been appointed sales manager, Chain Div., McKay Co., Pittsburgh, Pa., succeeding **Rowland Erving,** who has been named director of the new market research department. Mr. Carey formerly was district representative in western Pennsylvania and parts of West Virginia.

R. Joseph Fitzgerald has been named sales manager of the combined companies of Jesse S. Morie & Son Inc. and the Goff Div., Mauricetown, N. J. **Edward C. Klank,** formerly with Lancaster

F. KERMIT DONALDSON
. . . ASAE president

GEORGE K. DREHER
. . . marketing director

KENNETH R. DANIEL
. . . Acipco executive v. p.

JACK B. KLUKKERT
. . . foundry superintendent

KARL KOSTENBADER
. . . AFS Chapter chairman

Foundry Supply Co., has been made sales representative for the eastern Pennsylvania area. **Ronnie Johnson,** formerly director of research and development, becomes New Jersey sales representative.

F. Kermit Donaldson, executive vice president, Steel Founders' Society of America, was elected president of the American Society of Association Executives at its annual meeting in Denver, Sept. 3-6. ASAE membership includes the leading trade association executives of the country.

William J. Eames has been named superintendent, Grinding Wheel Div., Electro Refractories & Abrasives Corp., Buffalo, N. Y. He joined the company in 1945 after graduation from Alfred University as a ceramic engineer.

George K. Dreher has been appointed director of marketing and development, Burnside Steel Foundry Co., Chicago. Most recently market development director, Steel Founders' Society of America, he entered the foundry industry in 1930, at Ampco Metal Inc., Milwaukee. In 1947 Mr. Dreher was appointed the first executive director of the Foundry Educational Foundation, and in 1953 he joined Waukesha Foundry Co., Waukesha, Wis. He was named secretary of the SFSA in 1954 and later became market development director.

Kenneth R. Daniel has been elected executive vice president, American Cast Iron Pipe Co., Birmingham. Recently vice president in charge of engineering and purchases, he joined Acipco in 1936.

George C. Davis Jr., formerly director of technical services, has been appointed director of technical planning, Kaiser Refractories & Chemicals Div., Kaiser Aluminum & Chemical Corp., Oakland, Calif. **Russell E. Pardee** has been appointed manager, technical services. Formerly serving the Mexico, Mo., area, Mr. Pardee will have headquarters in Oakland.

Jack B. Klukkert, formerly assistant superintendent of Fontana Works, Kaiser Steel Co., Fontana, Calif., has been appointed superintendent of the new ingot mold foundry at the Indiana Harbor Works of Inland Steel Co., Chicago. He will also assist in the design, engineering, and construction of the new facility which will be completed in 1963.

Karl Kostenbader, superintendent of foundries, Bethlehem Steel Corp., Bethlehem, Pa., has been elected chairman, Philadelphia Chapter, AFS, for 1961-62. He joined Bethlehem in 1926 and has held his present post since 1956. **Philip J. Keely** has been elected vice chairman of the chapter. Mr. Keely is with Northern Bronze Corp., Philadelphia.

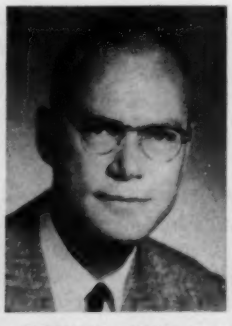
Norman Block has been appointed director of engineering and research, Western Precipitation Div., Joy Mfg. Co., Los Angeles. Previously he was director of materials research, Foster Wheeler Corp., New York.

Russell B. Miller has been appointed general sales manager, Chicago Pneumatic Tool Co., New York. He will be responsible for sales co-ordination of the company's products.

Samuel W. Bradstreet has been appointed technical director, Elec-

WILLIAM J. EAMES
. . . becomes supt.

RUSSELL E. PARDEE
. . . promotions at Kaiser Refractories



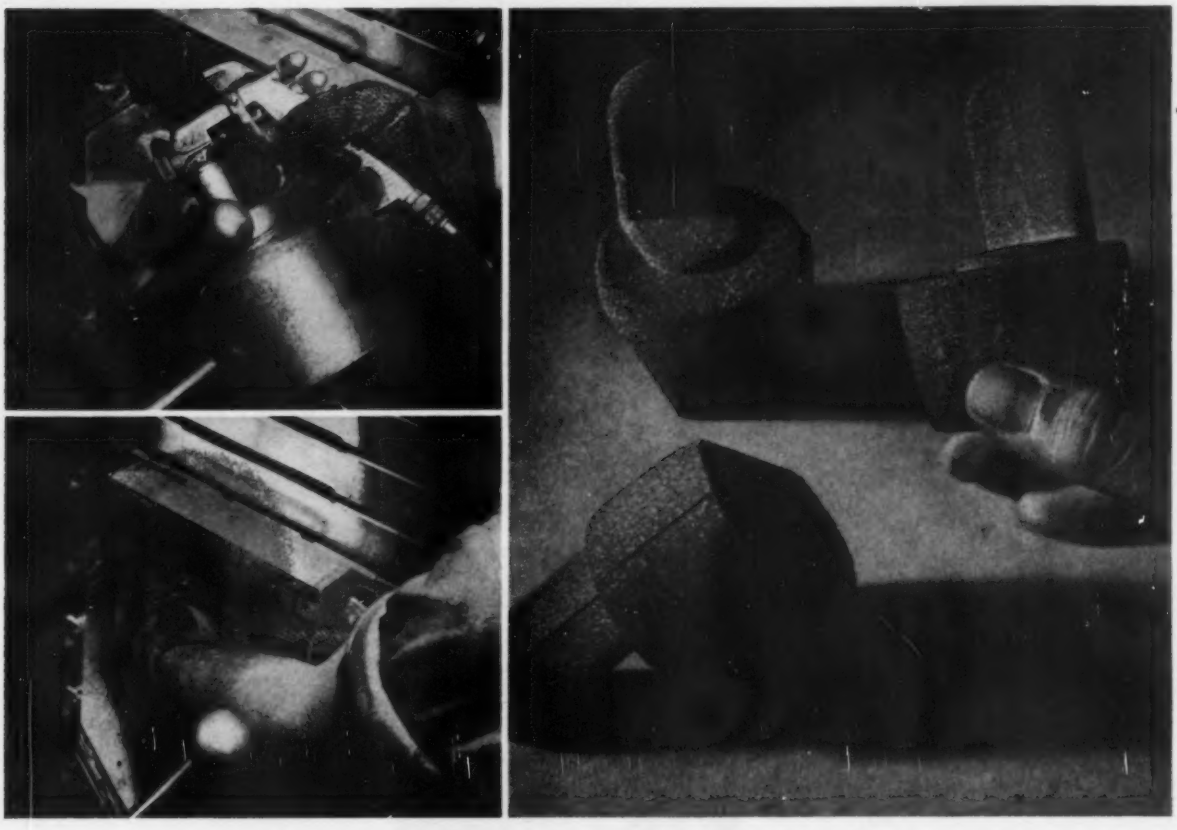
GEORGE C. DAVIS JR.
. . . promotions at Kaiser Refractories

NORMAN BLOCK
. . . joins Joy Mfg.

RUSSELL B. MILLER
. . . general sales mgr.

SILICONE NEWS from Dow Corning

Profitable coremaking



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It takes only a light coating of Dow Corning 8 silicone emulsion on patterns to obtain instant release — even when deep draws with small diameters are encountered. The silicone release coating resists heat . . . doesn't flash off or evaporate at curing temperatures . . . doesn't carbonize. Build-up on patterns is kept to an absolute minimum. Patterns stay clean many cycles longer — you may even find fewer are needed.

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Dow Corning

SAMUEL W. BRADSTREET
. . . technical director

tro Refractories & Abrasives Corp., Buffalo. Mr. Bradstreet previously was supervisor of inorganic technology at the Armour Research Foundation, Chicago.

William D. Walther has been elected chairman, Dayton Chapter, American Society for Metals. He is technical director, Dayton Steel Foundry Co., Dayton, Ohio.

A. M. Randolph Charrington Jr. has joined Aluminum & Magnesium Inc., Sandusky, Ohio, as eastern representative, covering the New England and middle Atlantic states. Formerly vice president of sales, North American Smelting Co., Wilmington, Del., he will have offices at 35 E. Wynnewood Rd., Wynnewood, Pa.

W. M. Kelly has been appointed manager, technical operations, Union Carbide Metals Co., division of Union Carbide Corp., New York. He was assistant director, alloys operations.

Ted Werner has been appointed sales manager, New York branch, Baker Industrial Trucks Div., Otis Elevator Co., Cleveland. Prior to this appointment Mr. Werner served as sales training manager, Clark Rental Corp., New York.

Frank D. Goll, formerly manager of ingot sales, has been named manager of sales to nonintegrated fabricators, Aluminum Co. of America, Pittsburgh. **Howard J. Fahrney**, formerly assistant product manager for ingot sales, succeeds him.

T. J. Simendinger has been named hoisting equipment product

To a foundryman who wants to stay COMPETITIVE:

CUT HANDLING IN HALF or better. Shell molds and cores are light to lift, easy to handle. No hoist is needed even for a core this big.

We'd like to help you.

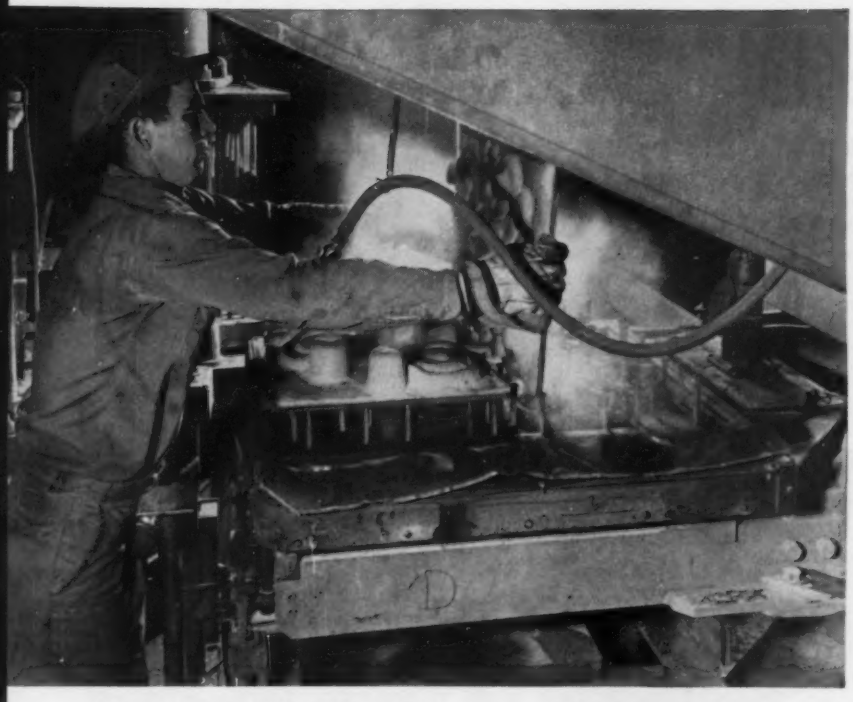
You've spotted the trend. You've observed that customers are getting more demanding. That quality standards are heading higher. That competition is growing tougher.

You're aware that service, always important, is becoming more important than ever.

And you've decided that these facts spell opportunity—for the foundry that can adapt to them and make the most of them.

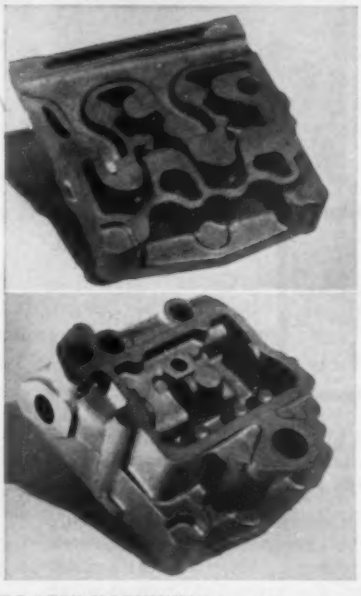
Shell molds and shell cores fit into this growth picture. We'd like to help you make the most of the business opportunities inherent in the shell process. There's a complete line of Durez® foundry resins to give you the results you want—consistently.

Just as important, there's a Durez man nearby who can help you use these resins to best advantage in your foundry. He talks your language. He wants to see you grow. Why not drop us a line today, and we'll have him pay you a visit.



STREAMLINE PRODUCTION of molds and cores. Modern shell-molding machines can produce a high-quality mold every 30 seconds. Shell cores let you get rid of wires, forget about core driers; save you a long baking cycle. Good collapsibility cuts shake-out time on intricate castings.

SAVE ON STORAGE SPACE—yet have plenty of molds and cores ready for rush orders. They're simple to store and there's very little risk of breakage. How much space could *you* save by stacking big cores like this?



DO LESS MACHINING (perhaps none at all) on castings that must meet close-tolerance specs. Get smooth bores in valves, engine blocks, pump parts—without grinding. Reduce the customer's machining cost by producing smooth, sand-free surfaces that machine faster, let tools last longer.

DUREZ PLASTICS DIVISION
Hooker Chemical Corporation, 1010 Walck Rd., N. Tonawanda, N.Y.

HOOKER CHEMICALS PLASTICS

For More Information Circle 685, Page 39

T. J. SIMENDINGER
. . . hoist equip. sales

sales manager, Yale Materials Handling Div., Yale & Towne Mfg. Co., Philadelphia. He had been district sales manager for eastern Pennsylvania, southern New Jersey, Delaware and Maryland.

J. M. Culbreth Jr. has been appointed sales manager, Accurate Die Casting Co., Cleveland. He was formerly senior buyer, Goodyear Atomic Corp., near Portsmouth, Ohio.

Norman H. Peterson has been appointed assistant to the president, Timken Roller Bearing Co., Canton, Ohio. **John F. Fellows** succeeds him as advertising manager.

Lewis I. Day, secretary and treasurer, Buckeye Steel Castings Co., Columbus, Ohio, has been elected president of Columbus Control of the Controllers Institute of America.

Whipple H. Manning has joined Cleco Air Tools, a division of Reed Roller Bit Co., Houston, as assistant to the sales district manager in Baton Rouge, La., succeeding **J. D. Senters**, who has been transferred to Harvey, La. **John C. Rowe** and **Ira T. Wilkinson** are new salesmen in Detroit and Kansas City, respectively. **Frank J. O'Neill** is now a member of the company's Division 540 as a salesman in Houston.

David C. Clark has been appointed manager, Merchandise Sales Div., Jervis B. Webb Co., Detroit. Mr. Clark, formerly sales manager of Webb Forging Co., also has been made treasurer and a company director.

Roger W. Williams has been made a member of the sales engineering staff, Chicago Eye Shield

Co., Chicago. He formerly was a research engineer at Battelle Memorial Institute, Columbus, Ohio.

William Beatty has joined Rotor Tool Co., Cleveland, Ohio, as sales engineer in the Philadelphia area. He formerly was associated with B&B Supply Co., Philadelphia.

William D. Clark, plant superintendent, Esco Corp., Portland, Oreg., was elected chairman of the Shop Practice Committee of the Alloy Casting Institute.

Raymond B. Goodale has been appointed grinding wheel sales representative in Cincinnati for Norton Co., Worcester, Mass., succeeding the late Sherwood F. Prescott. **Michael R. Parrott** will succeed Mr. Goodale as sales representative in Iowa. **Robert L. Hager** has been appointed abrasive grain sales representative in Pennsylvania, succeeding **Frank A. Singer** who has retired.

Thomas M. Colligan has joined H. P. Deuscher Co., Hamilton, Ohio, as sales representative for ductile and gray iron castings. Mr. Colligan previously was production manager, Peerless Foundry Co., Cincinnati.

THOMAS M. COLLIGAN
. . . joins H. P. Deuscher

James Davis has joined Rotor Tool Co., Cleveland, as sales engineer in the Youngstown, Ohio, area. He was with Radio Parts Co., Pittsburgh.

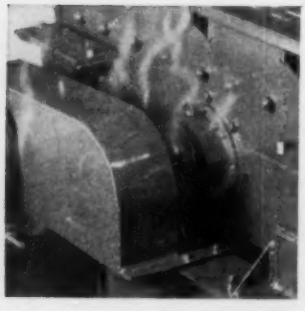
Bruce A. Fountain has been named electrode products sales representative in Chicago for National Carbon Co., Div. of Union Carbide Corp., New York, succeeding **Charles A. Taussig,** who has been assigned to electrode product technical service in New York. Mr. Fountain joined the company in 1942.

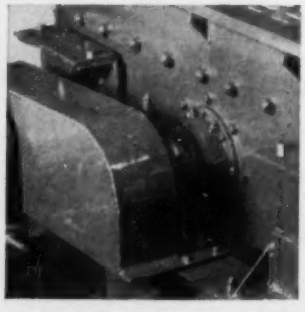
Dr. Russell P. Heuer, vice president, General Refractories Co., Philadelphia, Pa., has been awarded the Francis J. Clamer Medal of the Franklin Institute. He will receive the medal because of his pioneer work in developing a basic brick for use in open-hearth steel furnaces.

Charles R. Hauth has been appointed assistant manager, technical sales, Harbison-Walker Refractories Co., Pittsburgh. He formerly was with technical sales in Pittsburgh.

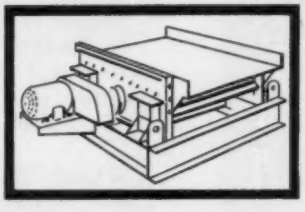
Clinton R. Carlisle has been appointed manager, Hartford, Conn., district, Allis-Chalmers Industries Group, Allis-Chalmers Mfg. Co., Milwaukee. He succeeds **W. T.**

NON-FLUID OIL
TRADE MARK REGISTERED





Ordinary Grease Burns and Dries Out



NON-FLUID OIL Gives Heavy Duty Lubrication

NON-FLUID OIL is specifically designed to fully meet the requirements for extra heavy duty service in shake-out bearings. Its melting point is high enough to take the heat involved and it is viscous and clinging.

NON-FLUID OIL forms a complete protective coating around the bearing and shaft ends without dripping away. It effectively lubricates interior bearing surfaces and at the same time gives an effective seal against entrance of foreign bodies. Grit and sand are prevented from entering into the bearing surfaces.

The majority of manufacturers of shake-outs and vibrating screens use and recommend NON-FLUID OIL. Try it yourself. Write today for a free testing sample and Bulletin 559.

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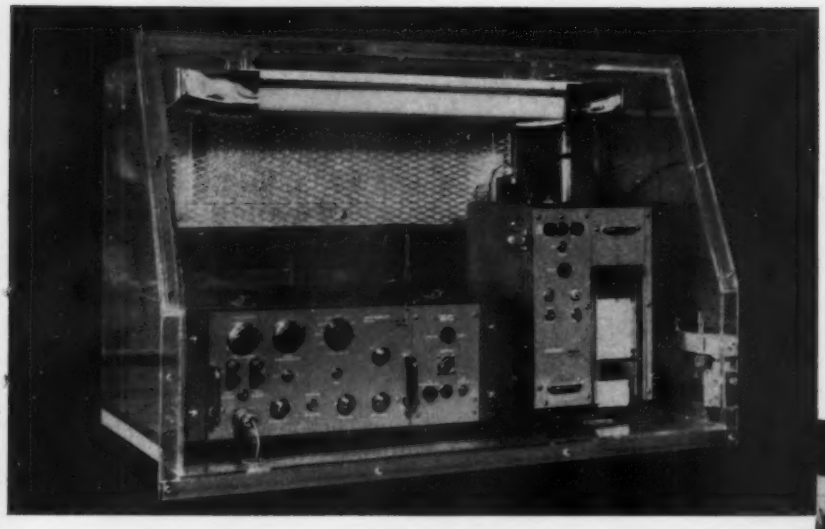
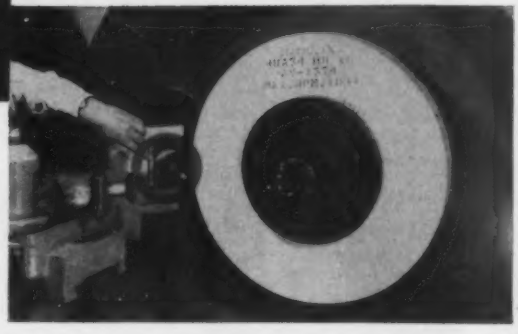
NON-FLUID OIL is not the name of a general class of lubricants but is a specific product of our manufacture. So-called grease imitations of a NON-FLUID oil often prove dangerous and costly.



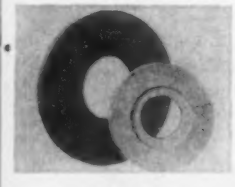
A Revolutionary New Way To Evaluate Grinding Wheel Hardness and Uniformity By Electronics



DYNA-GRADED®

Grinding Wheels by MACKLIN

Developed under the direction of the Macklin Research Department



On May 10, at the Production Engineers' Conference at the A.S.M.E. at Toronto, a paper was presented on a method of scientifically determining grinding wheel hardness and uniformity. It involves using the Dynamometer, illustrated above, to *accurately determine wheel hardness and uniformity across the entire cutting face of the wheel under controlled rotating conditions which simulate actual grinding.*

Here's How it Works . . .

Minute amounts of abrasive are crushed from the wheel's cutting surface by a conical, hardened steel wheel which is in running contact with the grinding wheel being tested. The force required to crush these minute amounts of abrasive and bond is electronically recorded on a permanent tape. Any significant variation in wheel uniformity or hardness is recorded on the tape. *This means* Dyna-Graded® wheel characteristics are precisely predetermined *before* the wheel is shipped. This means we can assure you more accurate wheel duplication, order after order. This means better cost control of your grinding operations.

For more than a year, Macklin has been Dyna-Grading wheels. Within a few months, Dyna-Graded wheels will be available for most of your high production grinding operations. Why settle for less? Put Dyna-Graded Macklin wheels to work protecting your production. *For further information, contact your Macklin distributor or write us direct.*

MACKLIN company Jackson, Michigan

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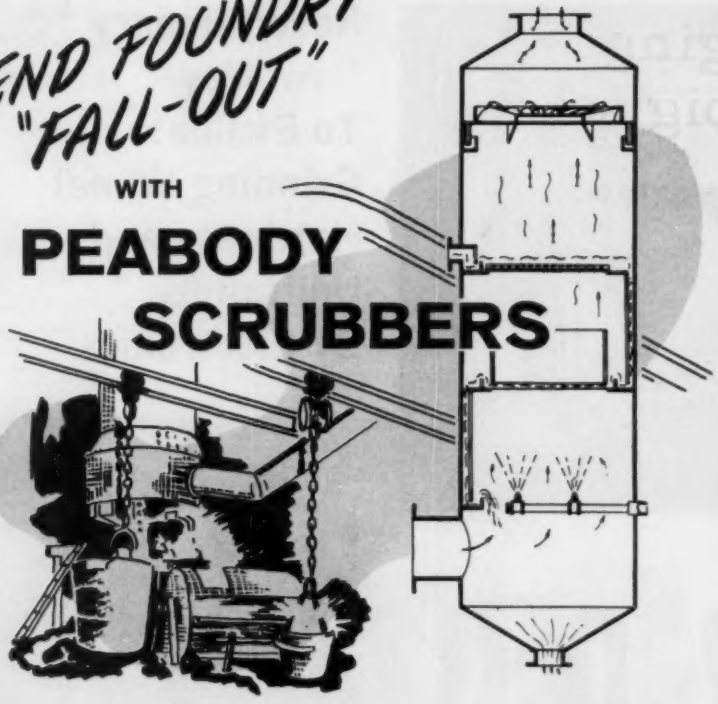
For More Information Circle 687, Page 39

END FOUNDRY "FALL-OUT"
WITH
PEABODY SCRUBBERS



...the most efficient wet-type dust arrestors!

Dirt and fume discharge from hot blast cupolas forms a "fall-out" that adds to atmospheric pollution problems. Now—this "fall-out" can be trapped with Peabody Scrubbers, leaving the vented discharge clear and clean. In the Peabody Scrubber, dirt particles are impinged on wetted targets then carried away by a scrubbing fluid that flows across custom-designed baffle plates.

Peabody Scrubber efficiencies on foundry service are in excess of 97%, with residual dust loadings in a range of 0.05 to 0.20 grains per standard cubic foot. They will remove 99% by weight of all dust one micron and larger. Units incorporating high-velocity agglomerating slot stages will remove sub-micron particles. These lightweight, compact Scrubbers are available in a capacity range from 1,000 to 250,000 cfm for *every* foundry application. Learn how you can end foundry "fall-out"... write today for complete information and Bulletin 203C.

1-259

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SUBSIDIARIES
In England: PEABODY LIMITED In Canada: PEABODY ENGINEERING CORPORATION OF CANADA LTD.

M. L. WATSON
. . . midwestern mgr.

Farnsworth, who becomes manager, eastern accounts, for the new cement industry department.

M. L. Watson has been appointed midwestern district manager, Planet Corp., Lansing, Mich. Formerly with Palmer Bee Co., Detroit, Mr. Watson will have his district offices at 1122 W. Lunt St., Chicago.

W. L. Batty Jr. has been made manager of the western district, Silicone Products Dept., General Electric Co., Waterford, N. Y. He joined the company in 1952 as a sales representative in the New England district.

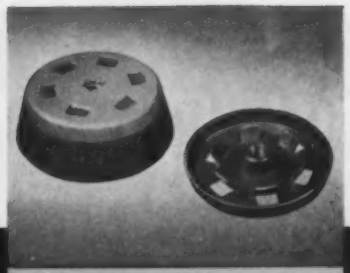
J. C. Sowers has been appointed product engineer, Michigan Abrasive Co., Detroit, Mich. He formerly was a sales representative. Mr. Sowers previously had been with Carborundum Co., Niagara Falls, N. Y.

R. A. K. Loxley has been appointed market research and development officer for the Council of Ironfoundry Associations and the National Federation of Engineering and General Ironfounders, London. Mr. Loxley is with Richard Thomas & Baldwins Ltd., Ebbw Vale.

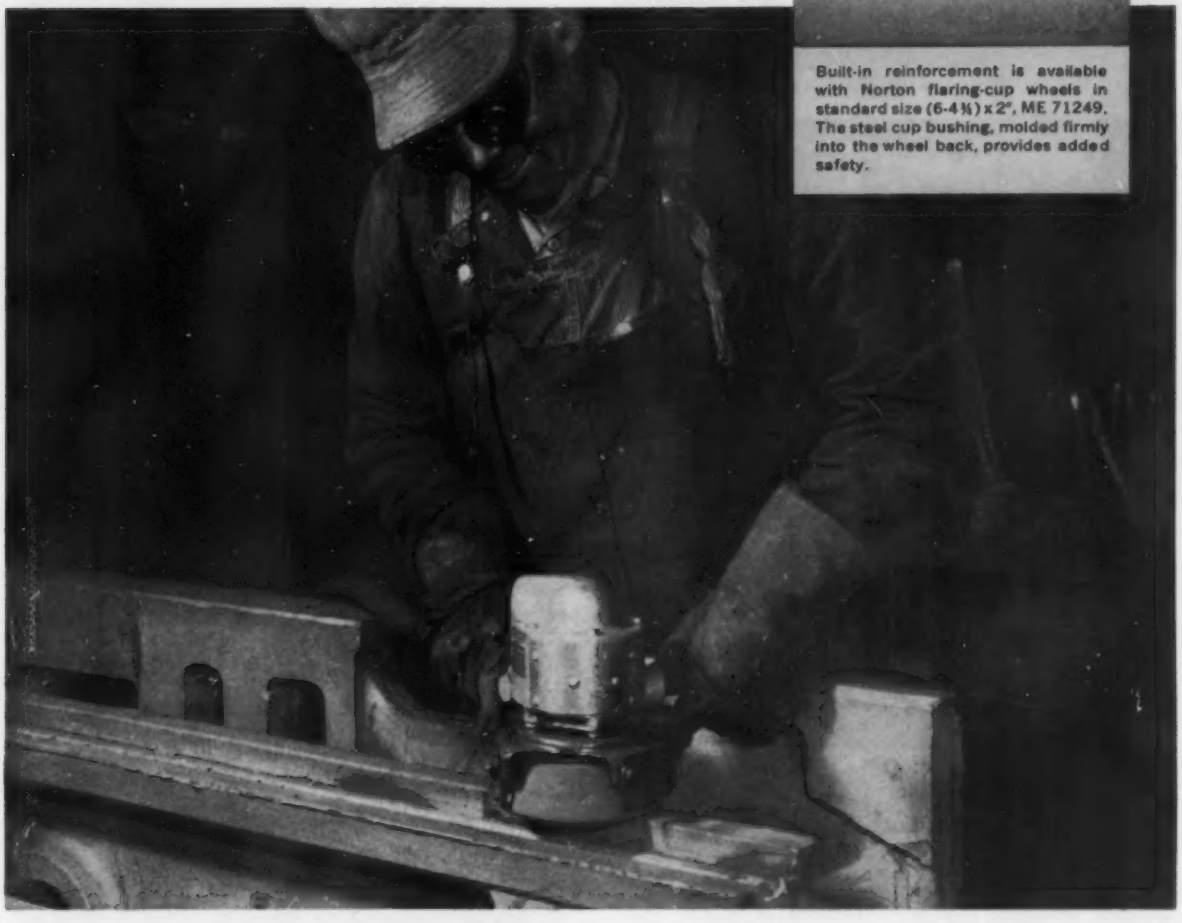
Robert S. Sweet recently joined Schenectady Varnish Co., Schenectady, as New England technical sales representative. He will reside in Boston.

Richard A. Bardos has joined Flick-Reedy Corp., Bensenville, Ill., as field engineer in the Michigan territory. He was formerly a tool designer at Arrow Automobile Engineering Co.

Small snagging wheels bring you big savings



Built-in reinforcement is available with Norton flaring-cup wheels in standard size (6-4¾) x 2", ME 71249. The steel cup bushing, molded firmly into the wheel back, provides added safety.



...when they're the right Norton wheels

For all snagging with small portables, as with heaviest duty swing frames and floor stands, Norton wheels bring new benefits to your operators and to *you*.

Operators like 44 ALUNDUM* B11 wheels for snagging steel and annealed malleable iron — and CRYSTOLON* K Bond wheels for snagging gray and unannealed malleable iron and non-ferrous metals. That's because both these abrasive-bond combinations are the best performing, easiest-to-handle wheels of their type.

You'll like the way these wheels, tested in your plant against any other wheels made, will cut your snagging costs per wheel, per job and per dollar.

Although 44 ALUNDUM abrasive is standard priced, it's no ordinary aluminum oxide, but extra tough and long-lasting. B11 bond wheels, precisely duplicated in half-grade increments of hardness, make it easier to choose exactly the right wheels. And CRYSTOLON silicon carbide abrasive teams with vitrified K Bond for ideal slow speed snagging.

Your Norton Man, a specialist trained in foundry grinding, can help you make money-saving selections of 44 ALUNDUM B11 and CRYSTOLON K Bond wheels. See your Norton Distributor, or write to NORTON COMPANY, General Offices, Worcester 6, Mass. Plants and distributors around the world.

*Trade-Mark Reg. U.S. Pat. Off. and Foreign Countries

NORTON
ABRASIVES

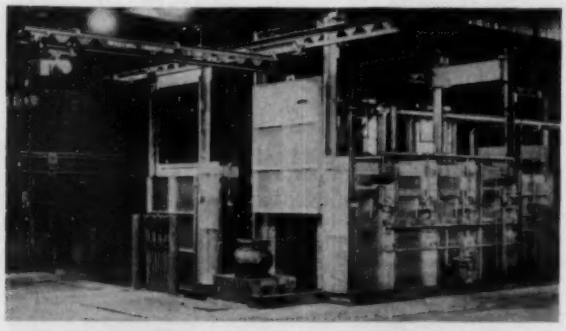
W-2016

Making better products . . . to make your products better

NORTON PRODUCTS: Abrasives • Grinding Wheels • Machine Tools • Refractories • Non-Slip Floors — BEHR-MANNING DIVISION: Coated Abrasives • Sharpening Stones • Pressure-Sensitive Tapes

Continuous Car Furnaces Preheat and Anneal

TWO FURNACES, of the continuous-car type, are being used in a large midwestern foundry for preheating and annealing with their welding operations.



Both units were specially designed and built by Waltz Furnace Co., Cincinnati, Ohio.

The preheat furnace holds a capacity of five carloads of castings. When a door is opened, one car comes out and one casting is removed to the welding area. The car is returned to the preheat furnace and the door is closed until the welding on the first casting is completed. The casting then is placed in the annealing furnace and another taken from the preheat furnace. When a car in the preheat furnace is empty, it is moved to the annealing furnace.

For More Details Circle No. 498—Page 39

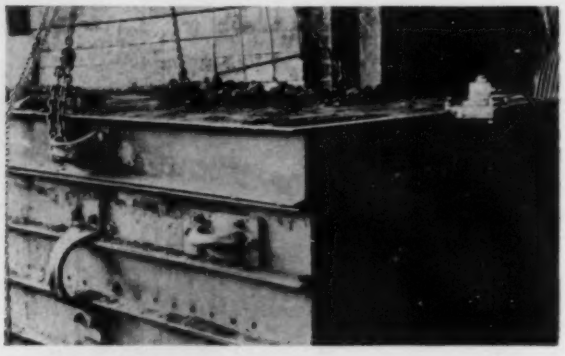
New Radiant Wall Furnace Improves Melting

THIS NEW radiant wall furnace, one of the first and largest of its kind used to melt aluminum ingot for foundry products, has been installed at Bodine Pattern and Foundry Co., St. Louis. Improvements in metal purity, more nearly uniform heating, and lower fuel consumption are major benefits of the unit, which was designed and built by Lindberg Engineering Co., Chicago. Installation of the equipment completes the current expansion program at Bodine.

For More Details Circle No. 499—Page 39

Small Vibrator Shakes Out Large Mold Copes

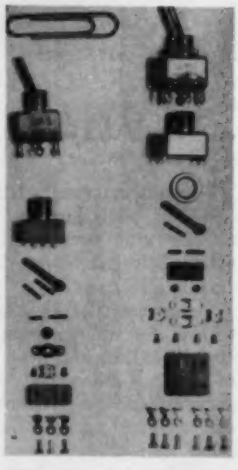
COPE SHAKEOUT has been accomplished continuously for over a year and a half at Bay City Foundry Co., Bay City, Mich., by the small vibrating unit shown here. The cope illustrated is a gaggered type and measures 14 ft x 6½ ft x 10 in.



The vibrating unit, manufactured by Martin Engineering Co., Neponset, Ill., has been credited by Bay City with a savings of $7500 per year.

For More Details Circle No. 500—Page 39

Switch Housings Are Investment Cast



INVESTMENT cast housings are used in the manufacture of tiny switches for use in laboratory equipment, electronic computers, and aircraft control panels. Torsion Balance Corp., Clifton, N. J., manufactures these switches which are so small that 100 of them will fit in a 4 x 5½-in. panel. Single-piece housings are used in assembly of both single and double-pole models.

Arwood Corp., New York, N. Y., furnishes the investment cast housings so that drilling is the only finishing operation necessary before the switches are assembled. Other manufacturing processes were investigated, but cost savings plus better electrical properties, corrosion resistance, and ability to withstand shock and vibration were the factors resulting in the selection of the investment process.

GREATER GRINDING EFFICIENCY ... LOWER "PER UNIT" COSTS

ALPHA
GRINDING WHEELS

Designed for fast action wherever quick metal removal is required. Their longer cutting life means more metal removed per disc wheel — reducing "per unit" production costs. And, because of this more efficient cutting action, Alpha disc wheels do not cause operator fatigue.

Made from abrasive grain and resinoid bond, Alpha disc wheels are strong and durable. Triple reinforcement provides greater safety while in operation.

Alpha grinding disc wheels are manufactured in 7 and 9 inch diameters in a complete range of grain sizes from 14 to 120.

Write today for full information.

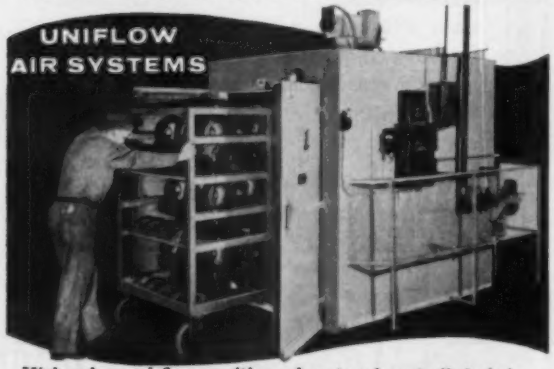
Atlantic Abrasive Corp.
A DIVISION OF ABRASIVE PRODUCTS, INC.
South Braintree 85, Massachusetts

STRAIGHT WHEELS • CYLINDER WHEELS • CUP WHEELS
CONES • PLUGS • MOUNTED WHEELS AND POINTS

For More Information Circle 690, Page 39

Production *PLUS* with DESPATCH OVENS

TEMPERATURES FOR APPLICATION TO 850° F. MAX.



High volume airflow, positive exhaust and controlled air intake in Despatch production ovens provide unexcelled operation over a wide range of applications. Recommended for chemical drying, curing insulating varnish on coils and stators, and finish-baking of japans, lacquers, enamels, and ceramics. Gas or electric heating are standard. *Despatch has been serving American industry for 58 years.*

Write today for bulletin No. 202-2FK

DESPATCH OVEN CO.

DESPATCH OVEN CO. 619 S.E. 8th St., Minneapolis 14, Minn.

For More Information Circle 691, Page 39

FOR CASTINGS THAT UNDERGO

HEAVY SHOCK AND HIGH STATIC LOADS

SPECIFY

PRECEDENT 71

ALUMINUM CASTING ALLOYS

HIGH YIELD STRENGTH • HIGH SHOCK RESISTANCE

Precedent 71 A and B are high strength, shock resistant aluminum sand casting alloys which in the condition as cast and aged at room temperature, develop the highest combination of physical and mechanical properties of any such alloy now available. Precedent 71A as cast and fully aged has a yield strength of 36,000 p.s.i. As solution heat treated and aged in the T6 condition, it has a yield strength of over 40,000 p.s.i. and still has over 5% elongation. Precedent 71B as cast and fully aged has a yield strength of 32,000 p.s.i. and at the same time has 7% elongation. Precedent 71 A and B offer a combination of high yield strength and high shock resistance not found in other aluminum casting alloys.

Write Today for Free Bulletin

WILLIAM F. JOBBINS INCORPORATED

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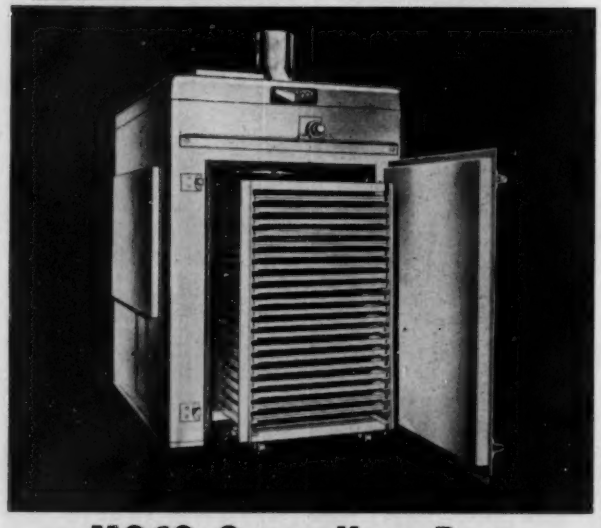
AURORA, ILLINOIS

For More Information Circle 692, Page 39

NEW TRENDS

CALL FOR

NEW METHODS



MOCO Ovens Keep Pace With Forward-Looking Foundries

Increased output at lower cost per unit is the result when you specify industrial ovens *custom-engineered* for your application. That's why Michigan Oven Company heat treating equipment is best for aluminum alloy processing. MOCO-engineered ovens are backed by years of technical research to insure maximum heat processing efficiency.

Michigan Oven Company is well-known for its engineering and craftsmanship in building ovens to fit the specific needs of manufacturers in the foundry industry.

Naturally, you won't want to miss any *sound* ideas on a better way to process your product. MOCO engineering has many of them. Wouldn't it be wise to investigate?

WRITE TODAY FOR FREE INFORMATION

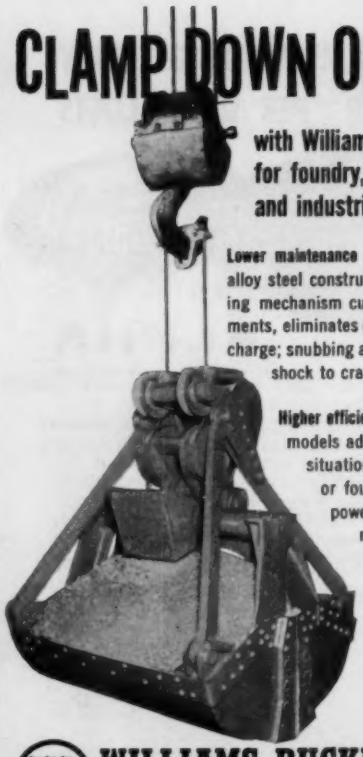
This MOCO technical literature points the way to many cost saving ideas. Send for it today without obligation.

MICHIGAN OVEN COMPANY

MOCO

415 BRAINARD
DETROIT 1, MICHIGAN

CLAMP DOWN ON COSTS



with Williams Hook-On Buckets for foundry, steel mill, and industrial service

Lower maintenance costs: clean-cut design, alloy steel construction; sureness of latching mechanism cuts downtime for adjustments, eliminates danger of accidental discharge; snubbing action minimizes opening shock to crane.

Higher efficiency: open or closed-head models adaptable to all headroom situations; can be reeved three or four parts of line for fast, powerful bites; automatic or manual trip; medium or heavyweight models for all types of service.

If you have special requirements for buckets, let our engineers discuss them with you.

WILLIAMS BUCKET DIVISION
THE WELLMAN ENGINEERING CO.
113 St. Clair Ave., N. E. • Cleveland 14, Ohio

For More Information Circle 694, Page 39

FOUNDRY CONSULTANTS

APPRAISALS . . . WAGE INCENTIVE PLANS . . . COST SYSTEMS . . . EXECUTIVE CONTROL . . METHODS PRODUCTION CONTROL SYSTEMS . . . PLANT REMODELING . . PLANT DESIGN . . CONTINUOUS SYSTEMS . . . SEMI-CONTINUOUS SYSTEMS . . . PRESENT OPERATION MODERNIZED

EDWIN S. CARMAN, INC.
1645 LEE ROAD CLEVELAND 18, OHIO

For More Information Circle 695, Page 39

NCP makes effective

PATTERN LACQUERS

1. Seals pattern to prevent moisture and water absorption.
2. Brushes easily—dries quickly.
3. Does not chip, peel, bubble, or blister, and is flexible.
4. Adds slip, promoting clean parting of pattern from sand.
5. Made in all colors.
6. Time tested material—successfuly used in pattern shops all over the country for over 30 years.

The National Chemical & Plastics Co.
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For More Information Circle 693, Page 39

For More Information Circle 696, Page 39

SCIENTIFIC
PRESSURE CAST
MATCHPLATES

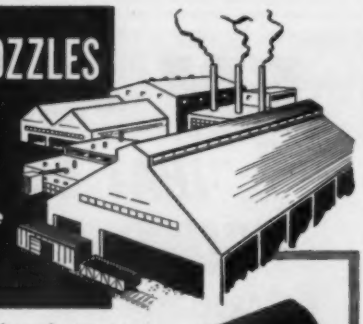
CHECKED FOR QUALITY
7 WAYS

Inspected at 7 points of manufacture for highest possible matchplate quality . . . Scientific is the only producer using patented new Fortschneider Shift Indicator.

THE SCIENTIFIC CAST PRODUCTS CORP.
1390 East 40th Street • Cleveland 3, Ohio

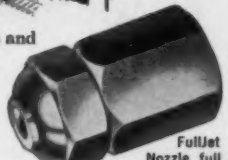
For More Information Circle 697, Page 39

SPRAY NOZZLES
to improve general foundry operations *and increase* product quality



Complete choice of nozzle types and capacities for every foundry need. Typical spray nozzles supplied are:

FOR GAS OR AIR WASHING
Fulljet or Whirljet spray nozzles in any material or capacity to fit your system. Open internal design and large orifices for non-clogging advantages.



FullJet Nozzle full cone spray pattern

FOR AUTOMATIC MOLD LUBRICATION
Pneumatic Atomizing nozzles, pneumatically actuated for required intermittent operation.

automatic Pneumatic Atomizing nozzle

Made by America's leading designers and manufacturers of industrial spray nozzles.

SPRAYING SYSTEMS CO.
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•

ADVANCE SPRAY NOZZLE DESIGN FOR NEW DIMENSIONS IN CONTROL AND PERFORMANCE

•

Complete stock of spray nozzles maintained for prompt delivery.

For complete information write for Catalog 24 . . . forty-eight pages of complete nozzle data.

For More Information Circle 698, Page 39

NEW

DIAMOND FOUNDRY SODA ASH BRIQUETTES

for fast, efficient, desulphurizing action

No inactive ingredients to add to cost. Pillow shaped for easy handling and fast, efficient desulphurization of molten metal in cupola or ladle. Diamond Foundry Soda Ash Briquettes permit greater use of scrap metal in melting, release entrapped gases and increase fluidity. Tough, moisture-proof 100-lb. bags keep them dry, effective and safer to use.

For prompt shipment and technical assistance, call your nearest Diamond sales office.
Diamond Alkali Company, Cleveland 14, Ohio

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Other Diamond Chemicals for the foundry: MOROC, silicate CO_2 binder, Caustic Soda, Chlorine, Solvents

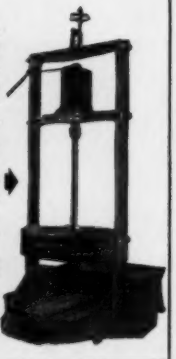
Diamond Chemicals

For More Information Circle 699, Page 39

POWERFUL...
CAPABLE...
RUGGED...
COMBS GYRATORY RIDDLES

"Greatest Name in Motion"

TYPE "CR". Complete price $425.00. 24" dia. round sieve. Sifts, fluffs, mixes, aerates sand. Height 4'6", weight 250 lbs., ½ H.P. enclosed motor.



TYPE "CS". Complete price $435.00. 24" square sieve. A continuous operation sieve. Requires no dumping, as refuse is ejected off to one side. Height 4'10", weight 295 lbs, ½ H.P. enclosed motor.

TYPE "HL". Price $315.00 complete, less sieves. Laboratory model especially designed for laboratory sand control, fitted with 1/6 H.P. enclosed motor.

PROMPT DELIVERY from your Foundry Supply House

TYPE "V". Price, 20" Sieve, $330.00. Does the work of 10 men. Screens sand, Fine, Medium, and Coarse. 20" dia. sieve with special clamp for 5-second changes. Height 4'6", weight 100 lbs., fully-enclosed 1/6 H.P. motor. Also available in Giant V-5 with 36" sieve for triple capacity . . . Price $600.00

MAIL THE COUPON NOW!

GREAT WESTERN MFG. CO.
Leavenworth, Kansas Phone MU-22291
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HEAVY DUTY
MODEL K

SPECIALLY SUITED TO PRODUCE FERROUS AND NON-FERROUS LONG TUBULAR CASTINGS

Castings up to 32 inches in diameter and 20 feet in length. These machines are ideal for jobbing foundry work as well as production.

Cast tubes of all alloys of non-ferrous metal as well as cast iron, alloy irons, steel, alloy steels and stainless steels.

Highly efficient type of water-cooling for permanent molds.

Trunnion machines built in many size ranges for specific requirements.

Illustrated Folder No. 160 Available on Request.

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P. O. BOX 947 TULSA 1, OKLAHOMA

For More Information Circle 701, Page 39

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"THAT GOOD" FOUNDRY COKE

DEBARDELEBEN COAL CORPORATION
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Phone: ALpine 1-9135
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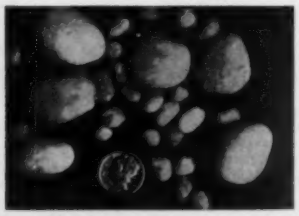
For More Information Circle 702, Page 39

HIGH QUALITY SILICA QUARTZITE PEBBLES

HIGH QUALITY • LOW ALUMINA



FINELY GRADED TO DESIRED SIZE

R. W. SIDLEY, INC.
TELEPHONE CY 8-3232
THOMPSON, OHIO

For More Information Circle 700, Page 39

For More Information Circle 703, Page 39

Complete facilities to produce all types of welded constructions . . . carbon or stainless steel and aluminum from 1/16" to 4" thick . . . to your specifications.

This includes tanks, chutes, hoppers, machine bases, stacks, breechings, angle rings, special cars, buckets, and other equipment.

Call or write for estimate. Let us show you how we can save you time and money.

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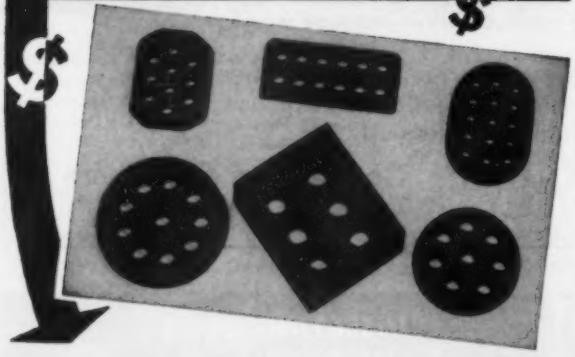
For More Information Circle 704, Page 39

Save Money *with* RUDOW STRAINER CORES



Custom Made • Will Duplicate Your Sample or Drawing • Unlimited Design Range • High Heat Resistance • Extra Hard • Saves Time—Trouble

RUDOW quality Strainer Cores cut rejects, cut costs, keep castings free of oxides, slag and impurities—simplify gating control and metal flow, for greater production. We offer you Free Samples of RUDOW Strainer Cores—made like your sample, or from your drawing. Write today—or phone MAin 6-1163.

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For More Information Circle 705, Page 39

you get MORE with MOROC®

the controlled silicate CO_2 binder

MORE SPEED. Curing time ranges from ten seconds to three minutes, depending on type of mold or core.

MORE LABOR SAVING. Cores are ready for use when they come from core box. You eliminate movement to and from ovens, handling of core driers, cementing of halves.

MORE FLEXIBILITY. Fast curing means faster handling of rush orders. There's no need to stockpile cores for future orders. You have the flexibility to meet customer needs on schedule.

MORE PROFIT. With MOROC you can get this extra capacity and flexibility with a smaller investment in equipment than would be required for additional ovens or shell-molding equipment.

MOROC COMES IN FOUR GRADES

MOROC 1. High-strength binder.

MOROC 2. High strength and good collapsibility.

MOROC 3. High strength and high collapsibility to meet demands of core-blowing equipment.

MOROC 4. Extra-high collapsibility and good flowability.

Other Diamond Chemicals for the foundry:
Soda Ash (briquettes & granulars), Caustic Soda, Chlorine, Solvents

Write for complete information. Diamond Alkali Company, 300 Union Commerce Building, Cleveland 14, Ohio

Diamond Chemicals

For More Information Circle 706, Page 39

FAST, ACCURATE, DEEP READINGS

Marshall Thermocouples Promote Castings Quality!

Marshall Enclosed-Tip Thermocouples assure strong, dense, uniform castings from every nonferrous melt! Tip can be immersed 3 inches to 30 inches or more in depth and stirred to speed pyrometer reading. You get accurate temperature from deep within melt in about 20 seconds! Hot junction tip, armored with enclosing tube of special alloy, withstands scores of immersions before low-cost replacement is necessary. Thermocouple wire can't be contaminated from melt or shortcircuited by slag! Rugged, well-balanced Marshall Thermocouples are convenient to carry and use, simple and economical to operate. Available as Furnace Type (below) in lengths up to 10 feet, for use with Stationary Pyrometer . . . or Ladle Type for use with Portable Pyrometer.

. . . write today for Free Catalog!

L. H. MARSHALL CO. 270 WEST LANE AVE. COLUMBUS 2, OHIO

For More Information Circle 707, Page 39

THE PROFITABLE ANSWER . . . . . **to rising costs is an effective method and production engineering program**

Our professional foundry engineering staff is successfully helping management to increase productivity—increase wages —reduce costs.
We are proud of the results obtained for our foundry clients.
Discussing our services involves no obligation or expense.
Information and references available upon request.

D. C. LATELLA & ASSOCIATES, INC. Consulting Engineers

624 WIDENER BLDG., PHILADELPHIA 7, PA. LOCUST 7-3372

For More Information Circle 708, Page 39

SLOTTED CORE BOX VENTS

X-TRA DEEP HEAD .156 Wide Slots .014

SHALLOW HEAD .031 Wide or Narrow Slots .014 .010

DEEP HEAD .093 Wide or Narrow Slots .014 .010

CO_2 TYPE DEEP HEAD .093 Wide or Narrow .014 Slots .010

Manufactured by **C. M. SMILLIE & CO.** 1124 WOODWARD HGTS FERNDALE 20 MICH

INSERTING DRILL

- MOST ECONOMICAL METHOD for INSERTING CORE VENTS
- CORRECT DEPTH
- UNIFORMITY OF HOLES
- FASTER INSERTION OF VENT

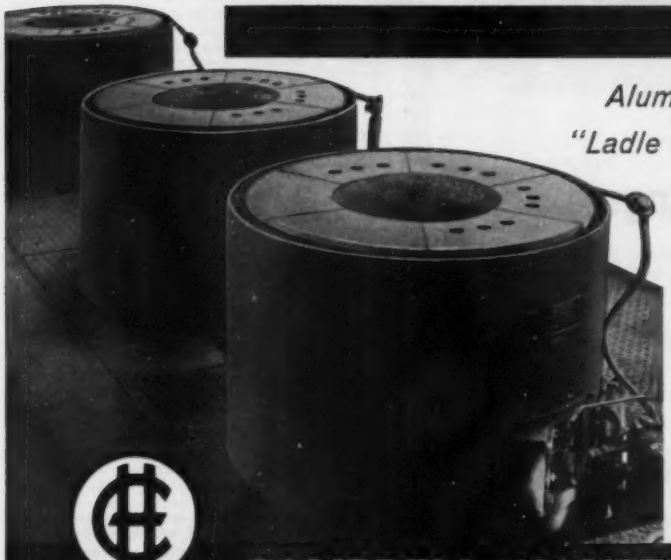
VENT CLEANER

- FOR CLEANING SLOTS
- MADE OF TEMPERED STEEL
- EASY TO USE

For More Information Circle 709, Page 39

BUILT BETTER FOR BETTER MELTING

HAUSFELD CUSTOMER APPROVED FURNACES



Aluminum Melting and Holding Furnaces
"Ladle Out" Crucible Type for Die Casting,
Permanent Mold, or Sand Casting

Forty-four years of continuous service to the non-ferrous foundry industry, under the same name and ownership, has earned a "buy with confidence" reputation for HAUSFELD FURNACES.

Write for Bulletin No. 103, today

THE CAMPBELL-HAUSFELD COMPANY
300-J Moore St. Harrison, Ohio

CAMPBELL-HAUSFELD Metal Melting Furnaces

For More Information Circle 710, Page 39

CLASSIFIED ADVERTISING

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PRODUCTION AND QUALITY CONTROL SUPERVISOR

To supervise the department of our plant making Ni-Resist and Ductile irons using induction furnaces. The person should have proven administrative record with a minimum of six years foundry experiences. Age 28 to 40. Man of action. Must know how to get things done. Excellent opportunity and top wages. Engineering degree not necessary.

NOBLESVILLE CASTING COMPANY, INC.
NOBLESVILLE, INDIANA
Telephone: Westfield, Indiana #3-3285
between 7 & 9 p.m.

METALLURGIST: RESEARCH & DEVELOPMENT

Must be fully experienced with good background in common and refractory metals. For unique process using high frequency induction principles. Responsible position for aggressive party. Good future with young progressive company. Start ground floor. Please send complete resume and state salary expected. West Coast. Address: Box 227, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

FOUNDRY ENGINEER

Should have considerable and varied experience with equipment, layout, methods and material flows. For interview in Chicago send complete information on education, employment history, personal data and family status. Replies will be held confidential. Address: Box 231, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

• HELP WANTED

WANTED
ANNEALING FURNACE SUPERVISOR
Experienced in continuous annealing of cast iron; metallurgical experience desired.

• • •

CUPOLA FOUNDRY METALLURGIST
Experienced in gray iron cupola melting practice for production shop.

• • •

Foundry is in New Jersey. Submit resume and salary requirements.

BOX 233, FOUNDRY
PENTON BLDG. CLEVELAND 13, OHIO

ALUMINUM FOUNDRYMAN

Eastern New York, as working assistant to superintendent. Knowledge of metallurgy and not less than 15 years' working experience with permanent mold casting processes. Good working conditions and fringe benefits. Will pay moving expenses. Apply stating salary requirements. Address: Box 212, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

ASSISTANT SUPERINTENDENT

Must be able to assume full responsibility and supervision of producing miscellaneous types of small gray iron castings. Job will require full knowledge of cope and drag work, match plate, pouring, sand control and core work.
This is an excellent opportunity for the right man between the ages of 35 and 45 for future advancement.

Send full resume of past experience and salary requirements to:

Personnel Director
MUSKEGON PISTON RING COMPANY
EAST GARDNER STREET
SPARTA, MICHIGAN

• HELP WANTED

SUPERVISOR

For brass fixture trim plant with administrative ability to start new operation. Send full resume. Address: Box 237, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

SQUEEZER FOREMAN

Company needs squeezer foreman to supervise mechanized squeezer line in malleable foundry. Send resume. Address: Box 224, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

MALLEABLE FOUNDRY & LIAISON MAN

Must be experienced in foundry operations, such as pattern layout work, foundry scrap control, and customer service-sales contacts. State age, education, experience, employment records and salary expected. Address: Box 232, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

NONFERROUS FOUNDRY SUPERINTENDENT

Man to supervise the complete operation of our nonferrous foundry consisting of 3 foremen and 100 hourly paid employees. Successful foundry experience, melting, nonferrous metallurgy, employee relations a must. Engineering degree and centrifugal foundry experience desirable but not required. Address: Box 252, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

CHIEF METALLURGIST
(Malleable Iron)

Metallurgical degree or equivalent experience in malleable iron melting & heat treating; knowledge of sand technology, gating, pattern layout, etc., highly desirable. Attractive salary for qualified man.
Write:

PERSONNEL DEPT.
LANCASTER MALLEABLE CASTINGS CO.
1170 LITITZ AVENUE
LANCASTER, PENNSYLVANIA

• HELP WANTED

• HELP WANTED

One of Germany's biggest and most important producers of sand, permanent mold and pressure die castings, Honsel-Werke AG., Meschede/Westphalia, offers a very interesting position as

Production-Manager

of their foundries.

A highly experienced and dynamic person is wanted.

All kinds of molds are produced by the company.

Please, contact Dipl.-Ing. H. Fr. Honsel, (21b) Meschede, Postfach 29, (Germany)

WANTED

• • •

MACHINE DESIGN ENGINEER

Wide experience in one or more of the following fields: earth moving equipment, powered farm equipment, mining equipment or foundry machinery. B. S. degree in engineering with five years' experience or equivalent required. Please give details of qualifications, experience, salary range, and availability in first letter. All inquiries will be held in strict confidence.

• • •

DESIGN DRAFTSMEN

Experienced in electrical and mechanical drafting and design. Degree not required. To work on design of heavy foundry equipment. Please give details of qualifications, experience, salary range, and availability in first letter. All inquiries will be held in strict confidence.

TYLER PIPE AND FOUNDRY COMPANY
P.O. BOX 2027 TYLER, TEXAS

FOUNDRY SALES ENGINEER

Must have excellent foundry experience selling gray iron castings. Vocational or college training required. Age 30 to 35. Tulsa, Oklahoma and surrounding areas. Foundry division of nationally represented company. Address: Box 236, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

FOUNDRY SUPERINTENDENT & MOLDING FOREMAN

Capable of making gray iron castings from ounces to tons.

BOX 242, FOUNDRY
PENTON BLDG. CLEVELAND 13, OHIO

SAND TECHNICIAN

Mechanized malleable foundry has opening for a sand technician to supervise sand system. Send resume. Address: Box 223, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

WANTED—SUPERINTENDENT

Gray iron foundry, midwest, employing 300. Must be top man experienced in automotive, agriculture type casting and jobbing. Excellent opportunity. Send all particulars. Address: Box 222, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

EXPERIENCED MAINTENANCE FOREMAN

For midwest foundry. Foundry experience helpful but not a must. Salary commensurate with ability. Only qualified need answer. Send resume to Box 215, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

ELECTRICAL ENGINEER

For midwest foundry. Foundry experience helpful but not a must. Salaries commensurate with ability. Only qualified need answer. Address: Box 216, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

PLANT MANAGER'S ASSISTANT

For cast iron plumbing fixture plant needs rounded out fixture manufacturing experience to back up manager. Send full resume. Address: Box 238, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

PROCESS ENGINEERS WANTED

With experience in investment casting required for development work. Salary open. Send resume giving qualifications, experience and salary desired to personnel manager.

CASTING ENGINEERS
2333 NORTH BOSWORTH AVE.
CHICAGO 14, ILLINOIS

• POSITIONS WANTED

FOUNDRY SUPERVISOR

Thirty years' experience supervising in gray iron foundries; both jobbing and high production on squeezers, rollovers and sand slingers. Well versed in sand control, gating and cupola operations. Address: Box 234, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

PERMANENT MOLD FOUNDRYMAN

Experienced graduate engineer capable in all phases of light metals permanent mold casting seeks responsible position. Address: Box 225, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

COREROOM SUPERINTENDENT

Or Coreroom Foreman. Nineteen years' experience in gray iron foundry. Age 43. Married with family. Jobbing or production, bench or floor work. Qualified to take complete charge of all coreroom operations. Willing to relocate. Address: Box 220, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

FOUNDRY EXECUTIVE

Thirty-seven years' experience with carbon steel; low alloy, pressure, and structural iron, including nodular. Aluminum and magnesium, aircraft quality; other nonferrous alloys. Age 57, good health. Steel to 20 tons, iron to 50 tons. X-Ray and magnetic test quality, modern techniques, product quality and process control, cost improvement. Good labor relations. Resume and references on request. Address: Box 213, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

FOUNDRYMAN

Competent and progressive foundryman would like to make change. Will relocate. Address: Box 239, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

SUPERINTENDENT OR GENERAL FOREMAN

Twenty-five years' supervisory experience in steel foundry jobbing and production. Includes carbon, alloy, and stainless steel—pressure and X-ray castings. Quality control, molding, melting, coremaking, cleaning, heat treating, sand mixtures, and gates and risers. Address: Box 243, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

FOUNDRY FOREMAN

Experienced foundryman with floor, machine molding, and core room supervisory experience. Stainless steel and iron. Green or dry sand molding. Versed in gating, risering, CO_2 core making and production procedure. Address: Box 251, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

SALES REPRESENTATIVE AVAILABLE

Desire position as representative for foundry supplies, equipment or castings in Michigan area. Presently employed. Thirty years' experience in iron and steel. Fifteen years' managerial experience including sales. Address: Box 226, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

SUPERINTENDENT OR GENERAL MANAGER

If your scrap is high and your costs are up I can help you. Have always been able to get foundry out of trouble and make profit for company. That is why I can make this statement. Results guaranteed or no cost to you. Have 28 years of practical experience in all phases of foundry operation; 50 years old. Can furnish references and any other information requested. Address: Box 228, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

PROFIT—DOMINATED

Hard-driving and versatile foundryman desires demanding position as manager's assistant or superintendent. Fourteen years of diversified gray iron jobbing and production experience. Journeyman. Engineer graduate with added business education. Young familyman. Will go anywhere.

BOX 249, FOUNDRY
PENTON BLDG. CLEVELAND 13, OHIO

STAFF LEVEL

15 years of experience in gray iron, aluminum and brass foundries. Duties; methods, estimating, cost, incentives, production and purchasing. Address: Box 235, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

SUPERINTENDENT OR MANAGER

Young foundryman thoroughly versed in all gray iron operations. Degree in Metallurgical Engineering. Interested in responsible position with opportunity. Address: Box 253, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

• POSITIONS WANTED

SUPERVISOR-METHODS AND TIME STANDARDS

Twelve years' varied I.E. foundry and manufacturing experience. Specializing work methods analysis and measurement, wage incentive installation and maintenance, other cost reduction areas. Have trained and supervised others in these activities and have designed and implemented related programs. Resume on request. DONALD JOYNT, 405 Greenbriar Drive, Lufkin, Texas.

SUPERINTENDENT—GENERAL FOREMAN

Practical and technical; presently employed in the East; over 30 years' experience; jobbing or production to 5 tons. Address: Box 244, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

PATTERN SHOP SUPERINTENDENT

Experienced pattern shop supervisor, knowledge all phases of pattern work and production foundry practices. Desire to relocate. Married. Address: Box 250, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

COREROOM FOREMAN

Twenty years' experience, all types of sand. Large and small cores. Best of references as to character and ability. Address: Box 247, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

FOUNDRYMAN

Experienced in gray iron and nonferrous metals, mechanization, design, patternmaking, gating, risering, costs. Presently employed as pattern supervisor. Address: Box 254, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

DESIGNER OF PERMANENT MOLDS

Specialist in missile and aircraft castings of Aluminum and Magnesium. Location New York —New England area. Address Box 218, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

• ACCOUNTS WANTED

MANUFACTURER'S AGENT

R. G. DYER COMPANY, 114 Dolly Lane, Chalfont, Pennsylvania. Phone: Van Dyke 2-9644. Would like one or two reputable lines to sell to the foundries and steel mill trade. Territory covering eastern Pennsylvania, southeast New York and New Jersey for the past 14 years.

• REPRESENTATIVES WANTED

SALES REPRESENTATIVE

We are interested in securing the services, on a salary plus travel expense basis, of an aggressive sales engineer to contact and sell the foundry trade. Must have a metallurgical background or equivalent practical foundry experience. Our company is prominent in its field, presently selling a widely used product to all types of foundries.

Man desired should not be over 40 years of age, preferably 30 to 35, free to travel extensively. Headquarters in a medium size midwestern town with moving expenses paid.

Send complete resume on education and experience and salary requirements. All inquiries held in strictest confidence. Please reply to:

BOX 230, FOUNDRY
PENTON BLDG. CLEVELAND 13, OHIO

• CONSULTANTS

CONSULTANT

Expert assistance in foundry operations gray iron, malleable iron and steel. Address: HERBERT F. MILLER, 589 Trade Winds Drive, Dunedin, Florida.

• WANTED-TO-BUY

WANTED TO BUY

Molding machines. International type JSK-7. R. E. Gilbert, GREAT LAKES FOUNDERS & MACHINE CORP., N. Washington Ave., Ludington, Michigan.

WANTED

(1) Car type annealing furnace. Oil fired. Good condition. Approximately 7' x 12' with 4' clearance above top of car.

BEAVER VALLEY ALLOY FOUNDRY CO.
MONACA, PENNSYLVANIA

• FOUNDRIES WANTED

FOUNDRY—WANTED—EQUIPMENT

Foundry investment organization needs used equipment to activate and mechanize a large foundry. Complete foundry with or without property will be considered. Please be specific as to price and when inspection can be made. Principals only. All replies confidential.

BOX 248, FOUNDRY
PENTON BLDG. CLEVELAND 13, OHIO

FOUNDRY WANTED

GROUP OF FOUNDRY ENGINEERS AND INDEPENDENT MANUFACTURERS WANTS TO PURCHASE FOUNDRIES (FERROUS AND NONFERROUS) WITH OR WITHOUT PROPERTY. PLEASE SUBMIT COMPLETE DETAILS AS TO CAPACITY, TYPE OF PRODUCTION, FOUNDRY EQUIPMENT, FLASK INVENTORY.

PRINCIPALS ONLY

ALL REPLIES CONFIDENTIAL

BOX 245, FOUNDRY
PENTON BLDG. CLEVELAND 13, OHIO

• FOUNDRY FOR SALE

FOUNDRY & MACHINE BUSINESS

Leading manufacturer of water works fittings selling complete foundry and machine shop. Owner is at retirement age and wishes to retire gradually over next few years. Founded 1930, consistent profitmaker. 8 acres, brick and steel buildings, main foundry 120 x 600. Over 200,000 square feet under roof, 2 rail sidings. Completely equipped. Receivables $50,000 more than payables, finished goods about $40,000. Equipment, trucks etc. worth over $500,000. Heavy backlog of orders; operating at capacity plus taking output of two other foundries. In distressed area, low labor costs, non-union. Will sell all stock in company for $300,000. 15% cash, balance over ten years. Can guarantee profit will pay for business. Jack Davis, AMERICAN CASTING SERVICE INC., Princeton, Indiana.

• FOUNDRY FOR SALE

STEEL AND GRAY IRON FOUNDRY FOR SALE

Metropolitan New York area. Small jobbing shop. Building is 5300 square feet, plenty of extra land for future expansion. Unrestricted, heavy industrial zone. Melting equipment as follows:

1—#4 Whiting cupola rated 3½ tons per hour.
1½ Ton Whiting side blow steel converter rated 1½ to 2 tons per hour.

Price for complete foundry is less than the replacement costs of the land, building and melting equipment.

BOX 246, FOUNDRY
PENTON BLDG. CLEVELAND 13, OHIO

NONFERROUS FOUNDRY FOR SALE

$15,000 for Half-interest.

$25,000 for ALL.

EARL LEWIS
2908-16 NORTH OCEAN BLVD.
FT. LAUDERDALE, FLORIDA

• OPPORTUNITY

FOR SALE

Match plate pressure casting equipment. Will sell outright or half interest with purchaser assuming active management of business. Address: Box 214, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

• FOR SALE

FOR SALE

One model 2½F SIMPSON mix-muller, approximately 40 cu. ft. capacity, complete with dust hood and 60 h.p. motor. Excellent condition. Used 3 years. Address: Box 219, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

FOR SALE

1—TLB Tracto Loader completely overhauled, new bearings, new hydraulic system throughout —$1000.00. Can be seen in operation at WARMAN ALUMINUM FOUNDRY CO., 5618 Center Hill Avenue, Cincinnati 16, Ohio.

FOR SALE

One motor generator, less controls. Ajax 30 KW. Good condition. Used 1 year. Must be disposed of. Sold to highest bidder. Address: Box 229, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

FOR SALE

2 Simpson #3 UD Mullers
Simpson #3, style H Muller, enclosed gear
Simpson #2, style H Muller, enclosed gear
3 Simpson #2 Mullers, style C w/loaders & aerator & water meter
Simpson #2 UD Muller
Simpson #1 style C Muller, one wheel
3 B&P Mulbaros
3 B&P Model L screenerators
2 B&P #M screenerators
2 B&P #S screenerators
2 Simplicity 2' x 3' portable sanditioners
Motive Jr. Sandslinger, 19" head—4" tip—2 speed—25/16 h.p.
B&P Stationary hydraslinger 22" head x 5" tip, complete with R & L arms, 2 speed, 40 diag. 25 h.p., with plate feeder
10 SPO 110 PJ jolt squeezers
10 Osborn 275 J jolt squeezers
4 SPO 113 PJ jolt squeezers
4 Osborn Model 276 PJ jolt squeezers
Tabor 40" x 58" hydraulic jolt rollover, 16" draw, very late
6 Int. PKL 14—jolt squeeze pin lift
SPO #2114G Jolt Squeeze Pin Lift—20" x 27" table—4" draw
6 Tabor 30" x 40" hydraulic jolt rollovers, 12" draw
Tannewitz 30" band saw—variable speed drive—new in 1960
Racine Band Saw—14" geared drive
Worthington 6 x 6 x 5 x 5, 25 H.p. air compressor direct connected, air cooled, 3—22440, 60 cycle.
Wheelabrator tumblast 36 x 42"
Wheelabrator tumblast 42 x 42"
Wheelabrator tumblast 48 x 72"
2 Wheelabrator 66" swing tables
Pangborn 6' rotoblast table, very late

PEK MACHINERY COMPANY
130 JACKSON STREET
BROOKLYN 11, NEW YORK
PHONE: EVERGREEN 8-3277 & 3278

• EMPLOYMENT SERVICE

FOUNDRY PERSONNEL SPECIALISTS

National Placement and Procurement of

GENERAL AND PLANT MANAGERS, PLANT SUPERINTENDENTS, FOREMEN—ALL DEPARTMENTS, METALLURGISTS, ENGINEERS, CONTROLLERS, ACCOUNTANTS, SALESMEN, SALES MANAGERS, PERSONNEL DIRECTORS, PURCHASING AGENTS

Confidential Inquiries Invited
From Employers and Qualified Applicants

For Fast Competent Assistance Contact

DRAKE PERSONNEL, INC. **FINANCIAL 6-8700**
JOHN COPE, DIRECTOR, 29 E. MADISON ST., CHICAGO 2, ILL.

FOR SALE

Partial listing of late type, well maintained equipment, available now.

AIR COMPRESSORS

Worthington, V type, 75 HP
Worthington, Air cooled, 100 HP

OVENS

Despatch, Gas, 8'D x 7'W x 8'H.
Porbeck, Gas, 8'D x 9'W x 6'H.
Young Bros., Gas, Monorail

CORE BLOWERS

Osborn Model #91
Demmler, Model 1-477

MOLDING MACHINES

International Rollover, G24 x 10
J. & J. Jolt Rollover, 920RX
Osborn Jolt Squeeze, 275J
Osborn Jolt Squeeze, 276J
Osborn Jolt Squeeze Strip, 712J
SPO Jolt Squeeze Strip, 2136G
SPO Jolt Squeeze Strip, 2148
SPO Jolt Pin Lift, 307
International Jolt Pin Lift, Type JDP
International Rollover, Type F

SAND HANDLING & PREPARATION

Simplicity 4 x 8 Shakeout, SOBG
Louden Monorail Pouring System
Newaygo Handy Sandy, #HS-7-G, two station

CLEANING EQUIPMENT

Wheelabrator 86" Swing Table, w/DC
Wheelabrator 48" x 42" Tumblast, w/Skip Loader & DC
Wheelabrator 36" x 42" Tumblast, w/Skip Loader & DC
Standard Double End Grinders, 30" wheels, vari. speeds

MATERIAL HANDLING

Hough Payloaders, Model HA
Towmotor, pneumatic tires, 4000#
Towmotor, pneumatic tires, 3100#
P.&H. Bridge Crane, 2 Ton Hoist
Whiting Bridge Crane, 5 Ton Hoist
KELLER Air Hoists, ½ & 1 Ton
WHITING Yard Crane, 5 Ton, 80' span x 300' runway

LADLES

Modern Covered Ladles, 200#, 400#, 3,200#

AIR RAMMERS, FLASKS, & CORE PLATES.

Send for complete listings.

THE PEERLESS FOUNDRY CO.

5648 VINE ST.
CINCINNATI 16, OHIO
PHONE Avon 1-6540

For More Information Circle 866, Page 39

• FOR SALE

FOR SALE

One—ELECTROMELT "V" FURNACE with 100-KVA Transformer and control panel, Year-1955, Capacity 200 lb.

****

Two—OSBORN MOLD MACHINES, Year-1955, Model-1024-24" Squeeze Cyl.

Submit offer to: Mfg. Staff

GENERAL MOTORS CORPORATION
GENERAL MOTORS TECHNICAL CENTER
TWELVE MILE & MOUND ROADS
WARREN, MICHIGAN
Attention: Purchasing Department

REPAIR AND REBUILDING SERVICE ON ALL PNEUMATIC TOOLS

We try to carry a complete line of "Hard Chrome Rebuilt Tools" at about half the cost of new tools. Before you discard your old tools, why not send them to us for our estimate on the cost of renewing them with our Hard Chrome Process?

CENTRAL PNEUMATIC SERVICE, INC.
512 LINDEN AVENUE
DAYTON 3, OHIO
PHONE: CL 2-2701

FOR SALE
SHELL MOLDING SETUP

1—"Shellomatic," Electric heated, automatic shell molding machine, complete with tailored exhaust hood. Pattern Size 20" x 26".

1—"Sancote" muller, 300 lb. cap. sand coating unit.

1—"Shellomatic" shell bonding press with resin tray.

Complete unit priced right or separately

BOX 221, FOUNDRY
PENTON BLDG. CLEVELAND 13, OHIO

SWING GRINDERS
FOR SALE
(Used—Excellent condition!)

FOX 10 hp. 3/60/220/440 volt takes up to 18" x 2" wheel $650.00
MARSCHKE 15 hp. 220-440 V. takes up to 24" wheel .....$750.00 each

C. GREENE EQUIPMENT CORP.
4014 W. 24th ST.
CHICAGO 23, ILLINOIS
LAFAYETTE 1-1322

FOR SALE

Ajax 40 kw induction furnace complete with 17# & 30# crucibles and accessories.

100# Rocking Arc Furnace with all electrical equipment and controls.

10# Detroit Rocking Arc Furnace, complete.

2000° Electric Oven, 25 kw. Doors each end. Hearth 18"x18"x48" long. Includes automatic temperature controller.

Shaico 18" x 24" shell molding machine, electric. Two-station manual operation. Complete with separate shell core blower.

Equipment has been used for experimental operations and is in excellent condition. Some items still unused. Low price for quick sale.

BOX 217, FOUNDRY
PENTON BLDG. CLEVELAND 13, OHIO

FOR SALE

PRACTICALLY NEW CENTRIFUGAL CASTING MACHINES MFGRD. BY NATIONAL SUPPLY in 1942-46. (1) 36" pipe cap. x 18' long max., min. 8" x 18' long.
(1) 10" pipe x 12' long max., min 2" x 12' long. Water cooled. Complete w/aux. equip., motors, pushers, pouring car, etc. NEVER USED.

EVEREADY SUPPLY COMPANY
805 HOUSATONIC AVE., BRIDGEPORT, CONN.
EDISON 4-9471

• FOR SALE

C. GREENE FOUNDRY CORP.

GOOD USED
FOUNDRY EQUIPMENT

SPO Jolt, Squeeze Pin Lift, model 2138C
SPO Model 9546 Jolt, squeeze, rollover draw
Simpson No. 2 enclosed gear muller
Simpson No. 3 Enclosed gear Muller
Simpson No. 1 Open gear Muller
Osborn squeezer 276J and PJ
(3) Pig Mold Conveyors
American Tumblast 27 x 36
American Tumblast 36 x 42 w/skip
J & J Model 918 Rollover
Herman 6,000 lb. Jolt Rollover
Sutter Core Rollover
International Model 30 x 8 Rollovers
International Model 24 x 10 Rollovers
International Jolt pin lifts all sizes
J & J Model 812S Jolt pin Lifts Table 30 x 38
SPO Rollover pattern draw Model RD 6815 table 36 x 68 draw 15"
International plain jolt machines all sizes
Federal San-Blo Models CB 40 and CB40 B
International core blowers all sizes
Champion core blower Model CB 10
International hand operated pin push ups
Robbins shakeout 4 x 6 and 6 x 10
Pangborn Table cleaning machine Model LG6 with 6' table and 24" aux. tables complete with Dust Collector
Ingersoll-Rand 100 hp Air Compressor
Air Compressors 25 hp.
Whiting coal pulverizer Model 30 complete
Whiting coal pulverizer Model 30A complete
Whiting No. 3½ Cupola
Dust Collectors many sizes
Fisher No. 1700 Melting Furnaces MNP
Fisher Aluminum Melting Furnaces 1000 lb cap.
Fisher Aluminum Melting Furnace 300 lb cap. motorized nose pour gas fired
Bondactor Model 1000L
Tessmer sprue cutters
Hough Payloaders Model HA ½ yard
Tractomotive payloader ¾ yd. cap.
Air hoists 1000 lb. to 4000 lb.
Ladles all sizes
Steel flasks all sizes
Core ovens all sizes
Beardsley & Piper Tractor type slinger

Many More Items Available
WE SOLICIT YOUR INQUIRIES
WE BUY WE SELL WE TRADE

C. GREENE EQUIPMENT CORP.
4014 W. 24th St.
CHICAGO 23, ILLINOIS
LAFAYETTE 1-1322

FOR SALE

SPO #116J Molding Machine Rebuilt and guaranteed.

MULBARO 3½ B&P, reconditioned and in A-1 shape.

MOLDERS FRIEND w/60" brush and extra brush. Rebuilt and guaranteed.

SANDSLINGERS (2) 16 x 4 and 19 x 4. Both rebuilt and guaranteed. **Reasonable.**

CORE OVEN Porbeck Dbl. drawer 48 x 60. Excellent.

SHAKEOUT Hewitt-Robins 4' x 6'. Excellent condition.

CUPOLA BLOWER GE 5400 w/50 h.p. motor, recently taken out of service and in good condition.

SKIP HOIST CHARGER for #7 or smaller cupola. Good buy.

"We lean over backward—or forward—to please you!"

McMAHON AND COMPANY, INCORPORATED
P.O. BOX 3014A AVONDALE STATION
BIRMINGHAM 12, ALABAMA
PHONE 592-4201

REVERBALE JR.

Type 1, 14" basin melting furnace. For gas or oil firing. Spare set of bricks (never used) included. Price $1000 FOB our plant. Address: Box 240, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

• FOR SALE

FOR SALE

SPENCER TURBO-COMPRESSORS

(1) 10,800 CFM @ 12 oz. pressure—Cat. #07560 S/N 138936. Driven by 75 HP West. motor 220/440 volt, 60 cycle, 3 phase—1750 RPM. **Type CB.**

(1) 11,000 CFM @ 8 oz. pressure—Cat. #0540 S/N 117339. Driven by 40 HP G. E. motor 220/440 volt, 60 cycle, 3 phase—1750 RPM.

(1) 8500 CFM @ 8 oz. pressure—Cat. #0525 S/N 117337. Driven by 25 HP G. E. motor 220/440 volt, 60 cycle, 3 phase—1750 RPM.

(1) 2000 CFM @ 8 oz. pressure—Cat. #0507 S/N 117336. Driven by G. E. motor, 440 volt, 60 cycle, 3 phase—1730 RPM.

Location—Eastern Pennsylvania

Write—Phone—Wire

LURIA BROTHERS & COMPANY, INC.
130 PRESIDENTIAL BLVD., NORTH
BALA-CYNWYD, PA. (SUBURBAN PHILADELPHIA)

Attn.: Arnold L. Landesberg—MOHAWK 4-9800

FOR SALE

12 x 10 Chicago Pneumatic Compressor with 60 H.P. Motor. Capacity 300 CFM. Compressor completely overhauled. Excellent condition. Price $1,450.00 f.o.b. Alpena. Address: THUNDER BAY MFG. CORPORATION, Alpena, Michigan. Phone: ELMWOOD 4-3181.

FOR SALE

One AMERICAN Sand Cutting Machine #132, Model HP, size 56. Used but in good operating condition. Contact STRATTON & TERSTEGGE COMPANY, Anchor Division, Box 311, New Albany, Indiana.

FOR SALE

960 Cycle Induction Melting Furnaces—Like new!
2500 lbs capacity—2 units.
1000 lbs capacity—1 unit.

Power supply not available.
We would consider any reasonable offer.

SABIN METAL CORPORATION
310 MESEROLE STREET BROOKLYN 6, N. Y.

DIE CASTING MACHINE

One never used 7-Z Castmaster die casting machine. 100 tons. Address: Box 241, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

• FOR SALE

G-U-A-R-A-N-T-E-E-D
SAND BLAST EQUIPMENT
SELL BUY TRADE
TERMS AVAILABLE
Designers and Erectors of Specialized Blast Equipment

4' Wheelabrator Table Blast	$2250.00
8' Wheelabrator Table Blast	2750.00
6' Wheelabrator Table Room	6000.00
6' Wheelabrator Air Table	1700.00
48 x 48 Wheelabrator Tumblast	3000.00
42 x 48 Wheelabrator Tumblast	2750.00
36 x 42 Wheelabrator Tumblast	1500.00
27 x 36 Wheelabrator, new rubber belt	3000.00
4' Sly Air Table	600.00
Sly Air bbl #4	350.00
9 LG Pangborn Table w/6-36" Spinners	4000.00
6' LG Pangborn Table, Late	3000.00
6' Pangborn Swing Table, Like New	6000.00
Pangborn 53 EN-2 Hand Cabinet	325.00
Rumelin 8 x 8 Room	1000.00
Pressure Tanks, all types	$150.00 up
Vapor Blast Cabinets	400.00
Vapor Blast Automatic Table	2500.00

All types and sizes of Hand Cabinets, Dust Collectors, Pressure Tanks, Rooms, Horizontal or Vertical Tumbling Barrels and Additional Sand Blast Equipment too numerous to mention.
$100,000 worth of Wheelabrator and Pangborn Spare Parts Priced 25% to 50% Less List.

170 STEEL SHOT MIXED WITH G80 STEEL GRIT .....$125.00 ton

DIAMOND SAND BLAST EQUIPMENT CO.
5654 W. Jefferson Ave.
DETROIT 9, MICHIGAN
VI-3-6750

SHELL CORE MACHINES

2—SPO SC-30A-1 fully automatic Holo Core Machines.

Used 1½ years. Excellent condition.

18 x 22 gas fired platen. ....$2900.00 each.

NOBLESVILLE CASTING CO., INC.
NOBLESVILLE, INDIANA

CLASSIFIED ADVERTISING RATES

Effective January 1, 1962

FOUNDRY

PENTON BUILDING, CLEVELAND 13, OHIO

INCH RATES PER INSERTION

Single Column 2¼" Wide	One Time	Three Times	Six Times	Nine Times	Twelve Times
1 inch	$ 30.25	$ 28.75	$ 27.25	$ 26.50	$ 25.75
2 inches	59.00	56.00	53.00	51.00	49.00
3 inches	86.50	81.75	77.00	74.25	71.50
4 inches	112.00	105.50	99.00	95.50	92.00
5 inches	136.00	127.75	119.50	115.25	111.00
6 inches	158.50	148.50	138.50	133.75	129.00
7 inches	179.00	167.50	156.00	150.25	144.50
8 inches	198.00	185.00	172.00	165.50	159.00
9 inches	215.50	200.50	185.50	178.25	171.00
10 inches (1 col.)	231.00	214.50	198.00	189.75	181.50
15 inches (1/2 page)	334.25	309.50	284.75	272.25	259.75
20 inches (2/3 page)	429.00	396.00	363.00	346.50	330.00
30 inches (1 page)	620.00	570.00	520.00	495.00	470.00

POSITION WANTED—Minimum advertisement set solid. 30 words or less: $5.00. Additional words: 20c each.

ALL OTHERS—Help Wanted, Employment Service, Wanted-To-Buy, Representatives wanted, For Sale etc., minimum advertisement set solid. 30 words or less: $11.00. Additional words: 40c each.

NOTE: If replies are to be sent to a box number in care of FOUNDRY, add 8 words to your advertisement for box number and address.

Any advertisement set in all capital letters, add 50% to the above rates.

Classified forms close on the 10th of the month preceding issue.

Cash discount: 2% 10 days. Classified rates not subject to agency commission.

Rates are based on total space used during one year.

Advertiser is protected for 90 days in event of rate revision.

Copy: Use of cuts and display type permitted on units of space one-third page or larger only. Any necessary copy preparation, art work and engravings to be paid for by advertiser. All copy subject to approval of publisher.

Color rate on request.

NOW LIQUIDATING

A large farm machinery manufacturer

DUCTILE IRON FOUNDRY

in Chicago

Buildings being wrecked.
Everything must be sold.

Annealing furnaces—Bridge cranes—American Monorail—Bucket elevators — Roller conveyors — Core conveyors—Belt conveyors—Mold conveyors—Steel apron conveyors—Sandbelt conveyors—Magnetic belt-conveyors — Core blowers — Core ovens—5 ton OET cranes 50′ span —8 ton OET crane 50′ span—430′ cranerunway—Dust collectors—Fans melting furnaces—Handy Sandy—Hoists—Modern inoculation car—Ladles—Toledo hot metal scales—Modern FA9 pouring devices—Geared Ladles—45″ magnet — 1½ yard electric bucket—Molders hopper line—#126 Milwaukee molders —#124 Milwaukee molders—SPO 506 rollovers—Milwaukee & Harvester pin lifts — #2 & #3 Simpson mullers pug mills — 14′ turntables—B & P nite gangs—Jr. Nite gangs. Royers—Screenarators—Shakeouts—Sand screens—Counting scales—Tractor type sand slingers—Sand hoppers—Tumbling mills—Wheelabrators.

Write, wire or phone for complete list

ACME

EQUIPMENT CO., INC.

126 South Clinton St.

Chicago 6,

Illinois

Telephone: Andover 3-3430

For More Information Circle 867, Page 39

NOW LIQUIDATING

the Modern Well-Equipped Foundry

Coldwater Foundry *only of* Homer Foundry

290 S. Clay Street — Coldwater, Michigan

AIR COMPRESSORS

INGERSOLL RAND PHE—100 hp. New 1954; Ingersoll Rand ESI 12 x 11 75 hp 1951. (3) Older Compressors—Air Receivers.

CLEANING ROOM

PANGBORN 14LG5 60″ tables; PANGBORN barrel 14GK2; (3) TUMBLING MILLS up to 42″ x 72″

CORE ROOM

Lewis wire straightners and cutoff; 2A Climax straightner; International R, RJ and G rollovers and jolt rollovers; Core plates transite and metal; Sutter #520 core rollover, Champion CB5—CB10—CB15, Demmler #3E—#4; International SB13; HANSBERG H5 and H12 core blowers and shooters; Coleman 2-compartment 5′ x 10′—Despatch 10′ x 10′ and 8′ x 20′ CORE OVENS; core racks—core buggies; Milwaukee #70 core grinder.

HOT METAL DEPARTMENT

FA and F9 modern pouring devices, ladle heaters, pig molds, Whiting mixing ladle; #9 Whiting cupola; WHITING INCLINED SKIP HOIST CHARGER WITH BUCKET and SCALE; Syntron feeder; 4000# TOLEDO platform scale; SPENCER 100 hp. CUPOLA BLOWER.

MATERIAL HANDLING EQUIPMENT

(2) CLARK FORK LIFTS (1 New 1961); (4) YALE and TROJAN FRONT END LOADERS; WHITE TRACTOR and TRAILER; FOUNDRY DUMP TRUCK; UNIT CRANE on rubber; 39″ MAGNET, clamshell bucket; AIR HOISTS; (4) 2000# Keller (7) 4000# Ingersoll Rand (8) 2000# Ingersoll Rand; 16 bridge cranes w/runway; hand trucks, core trucks, hydraulic lift trucks, wheelbarrows.

MISCELLANEOUS

Rotap, speedy moisture teller; pipe threader; belt lacer; steam jenny; electric welders; grease equipment; 200 TONS STEEL FLASKS, 200 ALUMINUM POPOFF FLASKS.

MOLDING DEPARTMENT

(2) SPO 2194 jolt squeeze pin lifts; (2) 195 Milwaukee jolt squeeze pin lifts; (2) Milwaukee 244 jolt squeeze strippers; Milwaukee 165 jolt squeeze pin lift; International RES jolt squeeze rollover; (2) DAVENPORT 34AJS jolt pin lifts; (10) INTERNATIONAL Type G 24 x 10, 30″ x 8″ and 20 x 8; (4) #815 J & J's; (6) International portable jolt pin lifts.

MULLERS

SIMPSON 3F; SIMPSON #1½ Style C; CLEARFIELD 404.

PATTERNSHOP

Walker Turner radial saw; Crescent 16″ jointer; patternmakers lathe; patternmakers benches & vises; delta drill presses; 20″ Crescent band saw; MASTER 24″ DISC SANDER w/dust collector; spindle sander; Walker Turner radial drill, bench grinders, pattern lumber and supplies.

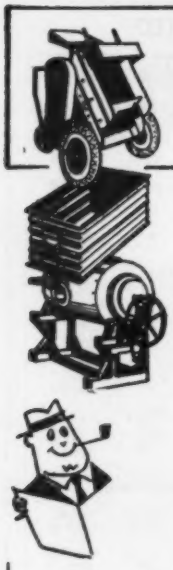
SAND SYSTEM

SIMPSON 3F MULLER with skip loader, aerator, dust hood; HARTLEY HYDRO-GUIDE timers, hopper, under muller conveyor; 24″ x 60′ JOY TROUGH BELT; 24″ x 180′ Distribution belt 9 hoppers; SIMPLICITY 36″ x 10′ FEEDER arranged for LOADER DUMPING; 24″ x 50′ Trough belt conveyor; Air operated skip hopper; SIMPLICITY 4′ x 10′ RING CRUSHER SCREEN MAGNETIC PULLEY—ROYER 30″ SAND CONDITIONER HANDY SANDY.

LIQUIDATING OFFICE **ACME EQUIPMENT CO., INC.**
290 S. CLAY ST., COLDWATER, MICH.
PHONE: BR. 9-9566

MAIN OFFICE **ACME EQUIPMENT CO., INC.**
126 S. CLINTON ST., CHICAGO 6, ILL.
PHONE: AN. 3-3430

For More Information Circle 868, Page 39



EUCLID FOUNDRY & MACHINE EQUIPMENT CO.

14919 SARANAC ROAD CLEVELAND 10, OHIO

AIR HOISTS

5—300 lbs. I-R "Air-Block" Type LC3
5—500 lbs. I-R Air hoists Model A
3—1000 lbs. I-R Air hoists Model B
1—4000 lbs. I-R Air hoists Model D
2—5 ton I-R Air hoists Model E
1—8 ton Detroit Air hoist
6—Curtis Pendant Class G 1 to 3 ton
12—Hanna Pendant 100 lbs. to 1000 lbs.

HOISTS ELECTRIC

1—1 ton Cleveland Tramrail 220/3/60
1—1 ton Chisholm-Moore 220/3/60
1—2 ton Yale 230 V. D.C.

ROLLER CONVEYOR

1500 ft. 16", 18", 24", 30", 36"

FURNACES (oil & gas fired)

Hausfeld, Fisher, Monarch
#100 to #3000 Stationary & tilting

ELECTRIC FURNACES

1—500# Lectromelt, 225 KVA, 2200 to 191 volts
1—1 ton Heroult, 800 KVA, 4300 to 300-225-178 volts

HEAT TREAT FURNACES

1—Lindberg Type 3854 EHV, 107 KW
1—Lindberg Type 6060 EH, 90 KW
1—Lindberg Car Type 72" x 84" x 96" 105 KW

CORE OVENS

1—Thermonic Dielectric Model M800A, 30 KW
1—Coleman Tower 40' high, gas fired
1—Porbeck 8 drawers, oil fired

SHAKEOUTS

1—Hewitt-Robins 12' x 10' 60,000 lbs. cap.
1—Hewitt-Robins 12' x 20' 68 tons cap.
1—3 x 5 Simplicity
1—3 x 10 Simplicity

SANDSLINGERS

1—B-P Stationary Riddle Type 19" head, 4" tip
1—B-P Stationary double belt 19" head, 4" tip

SAND MULLERS

Simpson
2—#1, Unit drive 4 cuft.
1—#1½, Unit drive 6 cuft.
2—#2 Type "E" 14 cuft.
2—#3 Unit drive 30 cuft.

Clearfield
2—#610, 14 cuft.
1—#930, 30 cuft.

Beardsley-Piper
2—3½8 Mulbaros
1—#50, 14½ to 29 tons per hr.

GRINDING EQUIPMENT

5 to 10 H.P. double end
30" to 53" Horizontal Gardner, Besley
7½ to 15 H.P. Swing Grinders, U. S., Mummert Dixon

SAND CONDITIONERS

B&P Screenarators Model S and M
2—Jeffrey Pugmills
1—American Type AA Sand cutter
1—Moulder's Friend

CORE BLOWERS

Champion, Demmler, International, Osborn, Sand Blo, Redford Taccone, 2 lbs. to 100 lbs. capacity

CUPOLA BLOWERS

Ingersoll-Rand, Roots, Spencer
15 to 75 H.P.

LADLES

3—4 to 6 tons bottom pour Whiting
3—3 ton T-pot
1—1½ ton T-pot
Lip pour ⅛ to 25 tons

BLAST CLEANING EQUIPMENT

1—42 x 48 Wheelabrator Tumblast
1—48 x 48 Wheelabrator Tumblast
2—26" Wheelabrator Continuous
2—72" Wheelabrator Swingout tables
1—48" Wheelabrator Swingout table
2—6' tables with aux. tables
1—6' Pangborn table, air induction
2—EN2 Pangborn Cabinets

DUST COLLECTORS

American, Sly, Rotoclone, Northern 600 to 4000 CFM

HANDY SANDYS and REDDY SANDY

single and double hopper type

HINES POPOFF ALUMINUM FLASKS AND JACKETS

large inventory of various sizes

MOLDING MACHINES

Automatic
2—Taccone's Model TDA-4, 24" x 24"

JOLT ROLLOVER & DRAW

Davenport
1—Model 40A, 3500# cap. 24" draw, 40" x 66" table
2—Model 8A28, 1500# cap. 12" draw, 30" x 40" table

Herman
1—10,000 lb. capacity 60" x 72" flask size
1—6000# cap., 40" x 72" table, 40" x 60" bumper
1—750# cap. floor type, 20" x 42" table

International
2—Type "G" 600# cap. 8" draw
2—Type "G" 1000# cap. 10" draw

Johnston & Jennings
2—Model 815, 1200# cap. 15" draw, 30" x 40" table
2—Model 918, 2000# cap. 18" draw, 44" x 54" table

Osborn
4—Model 601 Portable, 10" draw, 24" x 30" flask
2—Model 442 Portable, 10" draw, 600 lbs. cap.
2—Model 444 Portable, 10" draw, 1000 lbs. cap.
2—Model 242 Stationary 12" to 19" draw, 1000 lbs. cap.
1—Model 243 Stationary 12" to 21" draw, 1500 lbs. cap.
1—Model 643 Stationary 17" to 21" draw, 2000 lbs. cap.
4—Model 405 Stationary 18" draw, 3500 lbs. cap.
8—Model 2047-4 Stationary 8" draw

Spo
1—Model 505, 400# cap., 6½" draw, 18" x 23" table
1—Model 508, 1200# cap., 12" draw, 28" x 30" table

Tabor
1—30" x 40" table, 12" draw, 1000# cap.
1—22" x 32" table, 10" draw, 600# cap.

JOLT, ROLLOVER, SQUEEZE, DRAW

Osborn
1—Model 3161 Rotalift
1—Model 431-4, draw 7", 600# cap.
1—Model 333, draw 9", 750# cap.

Spo
1—Model 917, draw 9", 750# cap.

JOLT, SQUEEZE, PIN LIFT

International
1—LJSK, 12" squeeze cyl., 6" draw
3—PKL, 12" squeeze cyl., 8" draw

Osborn
6—710 PJ, 10" Squeeze cyl., 6" draw
6—712PJ, 12" Squeeze cyl., 6" draw
4—716PJ, 16" Squeeze cyl., 7" draw
1—720U, 11" Squeeze cyl., 4" draw

Spo
2—2114G, 11" Squeeze cyl., 4" draw
2—2136, 13" Squeeze cyl., 6" draw

Milwaukee
2—125-3, 12" Squeeze cyl., 5" draw
1—216, 21" Squeeze cyl., 12" draw

Davenport
1—Model 34AJS, 2500# cap., 12" draw

Herman
1—20" x 36" table, 1500 lbs. cap.
2—36" x 42" table, 4000 lbs. cap.

Johnston & Jennings
1—1216S, 3000 lbs. cap., 16" draw

Osborn
1—561, 40" x 50" table, 12" draw, 5000# cap.
1—560, 32" x 45" table, 12" draw, 2500# cap.
1—540, 29" x 38" table, 12" draw, 2000# cap.
1—558, 20" x 24" table, 4" draw, 550# cap.

Spo
2—3070, 28" x 35" table, 10" draw
1—3058, 23" x 27" table, 8" draw

Nichols
2—Model 24-54D, Flask size 24" x 27" 24" Squeeze Piston—1600# Jolt Cap. Frame Strip

PLAIN JOLT

Davenport
2—Model AJ-10, 30" x 45" table, 3000# cap.

Osborn
1—Model 103, 54" x 66" table, 6400# cap.

J & J
1—42" x 50" table 5000# cap.

PUSH-OFF

Champion
4—AL 2424, 8" lift, 2000# cap.
1—AL 3036, 6" lift, 3500# cap.

International
1—LP-6, 8" lift, 1000# cap.

CORE ROLLOVER MOLDING MACHINES

International, Osborn, Tabor

JOLT SQUEEZE MOLDING MACHINES

Stationary and Portable, 10", 12", 13", 16" squeeze cyl.

ASK FOR OUR COMPLETE LISTING—CALL GLENVILLE 1-1222

For More Information Circle 869, Page 39

PARTIAL LISTING OF EQUIPMENT NOW AVAILABLE — INQUIRIES INVITED

SAND MULLERS

CLEARFIELD

MODEL	PAN. DIA.	CAPACITY
404	4'	400#
610	6'	1500#
930	9'	3000#

BEARDSLEY & PIPER

MODEL	CAPACITY	AIR COOLED
30	4 cu. ft.	Yes
40	6 cu. ft.	Yes
60	12 cu. ft.	Yes
70	15 cu. ft.	Yes
80	20 cu. ft.	Yes

ALL CAN BE EQUIPPED WITH SKIP HOIST MULTRAMATIC CONTROLS, ETC.

SIMPSON

MODEL	PAN. DIA.	CAPACITY	DRIVE
1-C	4'	400#	Open
1-H	4'	500#	UD
1½	4'6"	700#	UD
2	6'	1500#	Encld.
2-B	6'	1500#	Open
3	8'	3000#	UD
3	8'	3000#	Encld.
3½	9'3"	5000#	UD

ALL CAN BE EQUIPPED WITH NATL. ENG. SKIP HOIST LOADERS.

LANCASTER

MODEL	PAN. DIA.	CAPACITY
EA4	59"	9 cu. ft.
EBG-4	59"	9 cu. ft.

OSCILLATING CONVEYORS

AJAX ENGINEERING (Lo-Veyor)

MODEL	SIZE	CAPACITY in T P H
LC 24-6-7	24" W x 7' L	70
LC 36-6-9DA	36" W x 9' L	100
LC 36-6-14 DA	36" W x 14' L	100
SIMPLICITY ENGINEERING		
OA-10-JA	24" W x 13' L	150
OA-10-JA	24" W x 11' L	150
OA-10-JA-2	30" W x 7' L	150
OA-10-JA	30" W x 13' L	100
OA-10-A	36" W x 10' L	200
OA-10-A	36" W x 16' L	200
OA-10-A	36" W x 25' L	600

SANDSLINGERS

B&P Stationary, Model "DB," 5' jib arm, 4' ram, 19" head, 5" cup, 2-speed, 20/13 HP. Raising & lowering arms or fixed.
B&P Stationary, Model "DB," 8' jib arm, 4' ram, 19" head, 4" tip, 20/16 HP. Raising & lowering arms or fixed.
B&P "Motive Jr.," 11' jib arm, 4' ram, 16" head, 4" cup, R & L arms, 2-speed, 20/13 HP.
B&P "Motive," 15' jib arm, 9' ram, 2-speed, 25/16 HP. With Raising & Lowering.

INDUCTION MELTING FURNACES

2—AJAX 20 KW convertor type, 3000 cycle, w/two 20# furnaces
5—AJAX 150 KW Melting Furnaces, 440 V, 60 cy. 1000 to 1200# brass
6—AJAX Model CS-1 35 KW Melting & Holding furnaces. 800# hold, 175# melt.
4—TOCCO 15 KW, 10,000 cy., 15# fur. Will melt 12# steel in 19 min.
1—10# HORACE DREVER, Indirect Arc Melting Furnace, 3000°F.

CUPOLA BLOWERS

INGERSOLL RAND

MODEL	C F M	PRESSURE	HP
FS-337	3000	20 oz.	25
FS-365	4500	16 oz.	30
FS-355	6000	16 oz.	40
FS-387	10,200	20 oz.	75
FS-377	10,500	20 oz.	85
FS-565	14,100	40 oz.	200
ROOTS CONNERSVILLE			
RCR	1040	20 oz.	10
RCB	9075	32 oz.	100

STILL LIQUIDATING! BUY FROM LOCATION PRIOR TO REMOVAL—ROCK ISLAND, ILLINOIS

I-R Cupola Blower, type FS-554, 8700 CFM, 2# pressure, 100 HP, New 1951.
FOUNDRY EQUIPMENT CO. "COLEMAN" Core Oven, 3-compartment. I.D. 77" W x 12' L x 78" H. Overall—8' W x 13' L x 7'4" H. Each comp. has individual gas burner & recirculating chamber.
DESPATCH Continuous Type Core Oven, style "S", 46' L x 20' W x 10' H, with 250' of Jarvis B. Webb #678 chain conveyor. With 50 carriers—4' x 5' x 6', each carrier having 8 shelves.
INTERNATIONAL Core Blower, model SB-15-H. Complete with sand reservoir. Ser. #60896-1.
INTERNATIONAL "REDP" Core Rollover, 24" x 36" x 12" draw.
SIMPSON #3 Unit Drive Sand Muller, with #3 skip hoist loader, dust hood, 50 HP motor, etc. Ser. #55112.
BEARDSLEY & PIPER #80 Speedmuller, batch 24 cu. ft., 8'6" dia. of pan, with batch hopper, water meter, dust hood, cooling fan, 125 HP motor.
AMERICAN AIR FILTER #27 Roto-Clone, arrangement "C", Type "W", with sludge ejector.
PANGBORN Multi-table Tableblast, model 9LG. 9' dia. main table. With six (6) 36" dia. auxiliary tables.
NEWAYGO 5-ton Plate Feeder, 5' dia.
2—OSBORN #442 Jolt Rollover Pattern Draw Machines.
2—INTERNATIONAL "PK-18" Jolt Squeeze Pin Lift Machines, size 18" x 8" draw—18" sq. cyl.
10—INTERNATIONAL Pin Strips, size 30 x 54 x 8 Y—portable.
8—MILWAUKEE Jolt Squeezers, model #104-5, table—17" x 21".
MORGAN 10-ton Crane, cab operated, 68' span, 240' runway, 16' high, lifting height 25', voltage—220V-DC.
SPO model 9546 Jolt Squeeze Rollover Draw, semi-automatic. Jolt—1000#, squeeze 14,500#, table—26" x 32".
2—MODERN #8 Cupolas w/swivel type skip hoist charger, scales, bins, etc. New 1952. Exceptionally clean.
ALSO—Air Hoists, Bridge Cranes, Tramrail, Tumbling Barrels, Core Racks, Ladles, Roller Conveyor, etc.

DIELECTRIC CORE OVEN

1—COLEMAN Model CD-75 Dielectric Core Oven 10' Wide 40' Long x 7' High—Mesh Belt Conveyor Type. Belt width 5'—Work area 64" Width x 19" High opening. Power required 165 KVA, 3 Phase, 60 Cycle, 460 Volts. Unit new in 1957

WHEELABRATOR TUMBLAST

size	capacity (cu. ft.)	
27 x 36	5	w/skip hoist
36 x 42	11½	w/skip hoist
48 x 42	17½	w/skip hoist
48 x 72	30	w/skip hoist

TABLASTS

AMERICAN #1—4' Plain Table
PANGBORN 6LG-14—6' dia. w/6-24" aux. tables
PANGBORN 9LG-14—9' dia. w/6-36" aux. tables
PANGBORN 6LK—6' dia.—72" swing-out table
PANGBORN 6LF—6' dia.—Plain Table

ELECTRIC DUPLEXING FURNACE

1—WHITING 10 ton Hydro-Arc Furnace for Duplexing Malleable Iron from cupola, 10' dia. shell, motorized tilt 9" dia. electrodes, cap. 18 to 23 ton per hour, w/Allis-Chalmers 2900 KVA transformer, 12,000 volt-motorized tap charger. New 1953.

JOLT ROLLOVER PATTERN DRAW

DAVENPORT

MODEL	TABLE SIZE	DRAW	CAP.
24 SA	24" x 38"	12"	1000#
28 SA	28" x 40"	12"	1500#
34 A	34" x 58"	15"	2500#
48 A	48" x 82"	24"	6000#
INTERNATIONAL			
AN	40" x open	20"	4500#
JOHNSTON & JENNINGS			
612	24" x 30"	12"	600#
815	30" x 40"	15"	1200#
918	44" x 54"	20"	2000#
1020-RC	50" x 60"	20"	3000#
OSBORN			
242-W	29" x 42"	12" to 19"	1500#
244	35" x 52"	16" to 25"	3000#
405	57" x 64"	26"	3000#
442	21" x 31"	10"	600#
601	24" x 30"	10"	900#
602	30" x 36"	12"	1200#
643	35" x 50"	20"	2000#
SPO			
506	18" x 23"	6½"	400#
506	24" x 25"	10"	600#
TABOR			
MODEL	TABLE SIZE	DRAW	CAP.
22"	22" x 32"	10"	600#
22"	22" x 42"	10"	600#
30"	30" x 40"	12"	1000#

JOLT PIN LIFT MACHINES

DAVENPORT

MODEL	TABLE SIZE	DRAW	CAP.
34 A-JS	36" x 46"	12"	2500#
INTERNATIONAL			
JDP 1200x8	24" x 26"	8"	1200#
JDP 3000x10	48" x 48"	10"	3000#
JL	32" x 52"	12"	2000#
JOHNSTON & JENNINGS			
68-SP	25" x 30"	8"	600#
MILWAUKEE			
1030	28" x 34"	8"	1000#
2036	32" x 38"	10"	2000#
2542	38" x 42"	12"	3000#
OSBORN			
540	32" x 52"	12"	2000#
560	32" x 45"	12"	2500#
SPO			
307	26" x 30"	10"	1200#

JOLT SQUEEZERS

MILWAUKEE

MODEL	TABLE SIZE	SQ. CYL.
104	18" x 15"	10"
123	17" x 26"	12"
141	20½" x 30"	14"
181	24" x 36"	18"
OSBORN		
275-J	16" x 20"	10"
276-J	17" x 26"	13"
SPO		
110-J	17" x 20"	10"
113-P	18¼" x 26"	13"

JOLT SQUEEZE PIN LIFT MACHINES

MODEL	TABLE SIZE	DRAW	DIA.	CAP.
PKL-12	18" x 24"	5¼"	12"	600#
PKL-14	20" x 28"	5¼"	14"	1000#
PK-16	20" x 30"	5"	16"	1700#
MILWAUKEE				
125	21" x 27"	8"	12"	1200#
145	24" x 30"	8"	14"	1700#
195	28" x 39"	10"	19"	3000#
196	16¾" x 39"	10"	19"	3000#
214	20" x 32"	10"	21"	2500#
244	22" x 32"	12"	24"	3000#
245	35¼" x 42"	12"	24"	5900#
246	23¾" x 42"	12"	24"	5900#
OSBORN				
710-PJ	16" x 25"	6"	10"	500#
712-PJ	18" x 28"	6"	12"	750#
714-PJ	20" x 31"	7"	14"	1000#
716-PJ	22" x 34"	7"	16"	1250#
SPO				
2136	21" x 30"	6"	13"	800#
2146	23" x 31"	6"	14"	1000#

JOLT SQUEEZE ROLLOVER DRAW

MODEL	TABLE SIZE	DRAW	CYL.	CAP.
MILWAUKEE				
167	32" x 33"	12"	16"	1000#
217	35" x 41"	12"	21"	1200#
OSBORN				
332	26" x 36"	9"	16"	750#
333	32" x 45"	11"	19"	1400#
SPO				
413-C	24" x 25"	10"	13"	600#
917-A	26" x 36"	9"	17"	750#
9546	26" x 32"	12"	16"	1000#

"Built on a Foundation of Mutual Trust"

a MACHINERY AND EQUIPMENT COMPANY

10900 CEDAR ROAD • CLEVELAND 6, OHIO • SW 1-3900

THE ACME BARGAIN PAGE

BLOWERS
I.-R. 12900 cfm, 100 h.p. 220-440 V. 20 oz.
GE 10500 cfm., 20 oz., 85 h.p., 220 V.
GE 7500 cfm., 20 oz., 89.6 h.p., 220-440 V.
SPENCER 7350 cfm., 16 oz., 50 h.p.
GE Centrifugal 6200 cfm., 24 oz., 58 h.p.
6000 cfm. INGERSOLL-RAND 32 oz.
SPENCER 3500 cfm., 20 oz., 40 h.p.
SPENCER 2250 cfm., 16 oz., 15 h.p., 220
SPENCER 1350 cfm., 32 oz.
NORTH AMERICAN 1050 cfm., 16 oz.
NORTH AMERICAN 850 cfm.
500 cfm NORTH AMERICAN 12 oz.
McKee 200 cfm
2—SPENCER Turbo 50 hp 4800 cfm 24 oz.
2—SPENCER Turbo 50 hp 3600 cfm 24 oz.

CLEANING EQUIPMENT
48" x 48" AMERICAN w/skip
6' Table PANGBORN
AMERICAN #2 Tablast 8-28" tables, late
PANGBORN GD1-Airblast Barrel
88" PANGBORN double swingout table
SLY #4 Blast Mills

CONVEYORS
17' BARBER GREEN Bucket Conveyor
1500'—458 Chain w/drive, will sell all or part
24" x 13'-9" Magnet Belt

CONVEYORS, OSCILLATING
24" x 40' Ajax
SIMPLICITY 18" x 24'
SYNTRON 24" x 6'
AJAX 12" x 20'6"
36" x 11' Ajax
8" x 13' Ajax
3' x 10' SIMPLICITY OA-10A

CORE BLOWERS
CB15 55# cores, Universal blow plate
CB5-4# cores
DEMMLER #50
1—DEMMLER #55 w/vibratory hopper
2—DEMMLER #55 w/plain hopper
DEMMLER 2EO
DEMMLER 2K
FEDERAL "SAN-BLO" CB 40
INTERNATIONAL 8B 15H, up to 150# cores. Hydraulic clamp and draw
INTERNATIONAL 8B 13, up to 60# cores
6—OSBORN 193 up to 50# cores
REDFORD Bench #2 & #4

CORE GRINDERS
1—MILWAUKEE 70-9

CORE OVENS
THERMONIC INDUCTION MODEL 1800A
2—Despatch ET, Draw Type

CORE ROLLOVERS
2—INTERNATIONAL GR hand ram power rollover 22" x 24" x 10" draw
INTERNATIONAL REDP Rollover 12" draw
BUTTER #500

CRANES
2—WHITING 10 Ton cap. 107'3½" span, OETC Outdoor type
1—WHITING 3 Ton OETC Cupola Charge Crane, 20' span

CUPOLA GUNS
1—Bondactor #1250 and 1000

CUTOFF SAWS
UNUSED DEWALT CUTOFF SAWS for ferrous or nonferrous metals cutoff or as sprue cutters. Flush blade adapter takes up to 20" abrasive blade or saw. Power Hoist to arm. Chain & Sprocket cross feed for working on heavy cast iron 48" x 60" "T" slot table or off table cutting or large work. Motor swivels horizontal to vertical in yoke.

DUST COLLECTORS
ROTOCLONE 8D 2000 cfm 5 hp
SLY #11—590 cfm
ROTOCLONE 8B 2000 cfm w/after cleaner

ELECTRIC MELTING FURNACES
1—DETROIT "LFA" 350# shell 13200 V.
1—DETROIT "LFC" 700# and 350# Tapered Shell 2300 V.

FURNACES
400# Fisher Motorized Tilt, Gas Fired
600# Fisher Stationary
600# Campbell Hausfeld Brass

GRINDERS, MISC.
U.S. #70 Comb. 20" disc & 20"x3"x1¼" wh
53" Hanchett Horizontal Disc
GARDNER 36" Vert Disc
BRADFORD Metalmaster 18" Disc
STANDARD 24" disc & snag

GRINDERS, SNAG
US #64 D.E. 20" x 3" x 10"
#5 Fox Sgl. Wh. 24" snag.
2—KLING type RT H.D. 24" x 3" x 12" D.E.
KLING H.D. 20" x 2" x 7" D.E.
5—#6 FOX Single Wheel 24" Snag
STANDARD 20" x 3" 7½ h.p.
STANDARD 30 h.p. Type 50—30" x 5"

GRINDERS, SWING FRAME
FOX 24" x 2" x 12", 15 h.p.
MARSCHKE 24" x 3" x 12" 20 h.p., 220 V.
U. S. 24" x 3" x 12" 15 h.p., 220-440 V.
2—MARSCHKE 3 h.p., 12" wheel

HEAT TREATING FURNACES
G. E. Elevator Type 1950° Atmosphere Generator 65" x 16' car. Electric. Late
G. E. Elevator type 2150°—96" x 144" car atmosphere generator. Electric. Late
3—ABBOTT 24" H x 22" Deep x 30" Wide, Gas Fired
HOLDEN #202 1850° Bright Hardening Annealing
HOSKINS 40 KW—1850°
25 KW Westinghouse 2000°

HOISTS
6000# Cleveland w/monotractor travel
6000# Electrolift
15—INGERSOLL-RAND 500# to 6000#
4—2000# R & M
1—500# Ingersoll-Rand LC-4

INDUCTION MELTING EQUIPMENT
30 KW Lepel Spark Gap

LADLES and POURING DEVICES
WHITING 16000# Crane
4000# Industrial Holding
WHITING 28 x 28—2300# Iron
MODERN 1000#—Geared Covered Crane
9—MODERN FA9 Pouring Devices 2000# cap.
6000# WHITING enclosed gear

MOLD BLOWER
TACONNE TD4 24" x 32" flask

MOLD CONVEYOR
366'—51—44" x 66" cars

MOLDING MACHINES
JOLT SQUEEZE PIN LIFT
6—MILWAUKEE 2646 Jolt Squeeze Strip rolloff—rolling molding machines 10" jolt cylinder; 1800# capacity, 26" Squeeze cylinder; 13" draw. Flask size 25½" to 29" wide, 52" long. FACTORY REBUILT.
MILWAUKEE No. 145-2, 27" x 30" table
8—OSBORN 712 PJ 18" x 28" table
1—CHAMPION J8L10P 18" x 21" table 6" draw

JOLT SQUEEZERS
MILWAUKEE 181-7, 24" x 36" table
MILWAUKEE #162—1, 900 lbs. cap.
2—113 PJ SPO
OSBORN 275PJ
25—124 MILWAUKEE Portable Jolt Sq.
6—104 MILWAUKEE Portable Jolt Sq.
8—MILWAUKEE 103-5 17" x 26" table

JOLT ROLLOVER DRAWS
2—918 J & J 2000# cap. 20" draw
643 OSBORN 2000# cap. 20" draw
40" TABOR 2000# cap. 15" draw
30" TABOR 1000# cap. 12" draw
SPO 500
34A DAVENPORT
DAVENPORT 24SA 900# 24" x 28" table
HERMAN 3000#
2—750# HERMAN 20" x 30" table
INTERNATIONAL RJ 20" x 12"

JOLT SQUEEZE ROLLOVER DRAW
OSBORN 231-332-333
SPO 413D
INTERNATIONAL RES

PLAIN JOLT
36" x 60" Herman

JOLT PIN LIFTS
1536 MILWAUKEE 1500# cap. 12" draw
1030 MILWAUKEE

MULLERS and MIXERS
1½ SIMPSON U.D. Model 700#
1—#3 UD Simpson
3—#2 Simpson UD
#40 B & P w/skip and water meter
#60 B & P Rebuilt mtr. & starter
CLEARFIELD #404
1—#2 SIMPSON OG
CLEARFIELD #610

ROLLOVERS
HERMAN 46" x 112" charge conveyor rollover 56" draw, late

SAND CONDITIONERS
AMERICAN 51"
ROYER NDC—ND2
SCREENARATORS L

SAND SLINGERS & EQUIPMENT
3—19"—2 speed Stationary
1—14' Turntables
3—7' Plate Feeders, 35 & 45 Tons
B & P 44-44 Speed Draw 12" draw

SAND SYSTEM EQUIPMENT
28' Newaygo Bucket Elevator 12" x 7"
3—7' B&P Plate Feeders, 35 & 45 Tons
2—18" x 52' Magnetic Belt
4' x 8' SIMPLICITY ring crusher screen

SAWS, BAND
30" LAIDLAW, Metal Cutting hydraulic

SCALES
FAIRBANKS charge scale 11250# cap.

SHAKEOUTS
6' x 10' SIMPLICITY, Som—11, Spring Mounted

4 x 8 LINK-BELT
2' x 8' Double Deck
4 x 6 LINK-BELT
6 x 10 HEWITT-ROBINS

SHELL EQUIPMENT
SHELL PROCESS 20" x 30" pattern size w/shell blender and bonding press

SPRUE CUTTERS
1—MILWAUKEE #85 TON
OBERMAYER 2 H.P.

STRAIGHTENING PRESS HYDRAULIC
225 ton Southwark
150 ton Farquhar "C" Frame
60 ton Lempco 4 post
25 ton Fox
25 ton Dennison

TESTING EQUIPMENT
ARLIN Automatic Rockwell, continuous
COLEMAN 55 Spectrophotometer
GOGAN Model 1414-2V

TUMBLING BARRELS
ROTO-FINISH Model DW 45-36
SLY, 24" x 48"; 3 H.P.
SLY, 30" x 60" Duplex

WOODWORKING—PATTERNSHOP
OLIVER #290 Dbl Arbor, Tilt-Arbor Saw
1—OLIVER 182D, 15" Disc Sander
CRESCENT 24" planer
6", 8", 12", 20" and 30" Jointers
24" x 36" Band Saws

OLIVER Model 103
PATTERN MILLER

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• AIR COMPRESSORS
75 hp I.R. water cooled, horizontal
100 hp WORTHINGTON air cooled, 2 stage

• BLOWERS
CENTRIFUGAL 5 Hp to 30 Hp
GE, WILBRAHAM—GREEN FISHER Positive Pressure & Cent., Cupola Blowers

• BLAST CLEANING EQUIPMENT
15" Cont. WHEELABRATOR Tumblast
26" Cont. WHEELABRATOR Tumblast
20" x 27" WHEELABRATOR Tumblast
27" x 36" WHEELABRATOR Tumblast
36" x 42" WHEELABRATOR Tumblast
48" x 42" WHEELABRATOR Tumblast
48" x 48" WHEELABRATOR Tumblast
48" x 72" WHEELABRATOR Tumblast
1-A WHEELABRATOR Multi-table
72" WHEELABRATOR Swing Table
WHEELABRATOR Pipe Cleaning Cabinet
18GN PANGBORN Blastmaster, late
PANGBORN 8' LF Table
PANGBORN Air Blast Room 8' x 8' x 11'
6' LK PANGBORN Table Room
6' LG PANGBORN Table
9' LG PANGBORN Table
DUST COLLECTORS AND SKIP LOADERS AVAILABLE FOR ALL MACHINES

• CONVEYORS
CARRIER Oscillating, 18" W x 54' L
LINK-BELT, Car type mold, 114 cars, 403' track, car sizes 18" x 42"
SIMPLICITY 24" x 10' Feeder w/hopper, Model OA-10-JA2
Roller Conveyor—Ask for List
LINK BELT Oscillating 18" W x 31'6" L

• CORE BLOWERS
DEMMLER #1, #2, #2A, #3K
INTERNATIONAL SB-13
MILWAUKEE TACCONE #4-M
OSBORN #91, #192, #91-10
TACCONE #4D, 10" Draw Stroke Cyl.

• DUST COLLECTORS
COMPLETE STOCK cloth, dry & wet types; 1000 to 30,000 CFM

• FURNACES
DIRECT ARC MELTING
500 lb. LECTROMELT, Top Charge
1000 lb. SWINDELL, Door Charge
2000 lb. HEROULT
1½ HEROULT
7' Top Charge Furnace
11' Top Charge Furnace
INDIRECT ARC MELTING
10# DETROIT
350# DETROIT LFA
750# DETROIT LFY, Conical Shell
1000# DETROIT AA
3000# DETROIT C, 500 KVA
INDUCTION MELTING & HEATING

175 KW AJAX Induction Melting Installation
Ideal for nonferrous work. With 2 lift coils. Can add standard tilt furnaces for steel.
SEND for complete details.

30 KW, ECCO Hi-freq. Vacuum Melting
30 KW, LEPEL, water cooled spark gap
40 KW AJAX Unit
35 KVA, AJAX Spark Gap, High Freq. steel
50 KW TOCCO JR, 2 Sta 9600 Cyc 90 Hp Motor
80 KW TOCCO JR, 2 Sta 9600 Cyc 140 Hp Motor
100 KW TOCCO JR, 2 Sta 9600 Cyc 175 Hp Motor
200 KW TOCCO JR, 1 Sta 3000 Cyc 310 Hp Motor
100 KW AJAX Production Heat Unit
GAS & OIL FIRED
400# FISHER, MNP
1000# HAUSFELD Hand Tilt, Oil fired, alum or magnesium
No. 900JC STROMAN, gas, Like new
6000# STROMAN, gas fired
20 Gas & Oil Fired Furnaces
HEAT TREATING
4' x 4' x 10' Gas Fired Annealing
210 KW LINDBERG conveyor box type
7' Rotary G.E. 200 K.W. 1950° F
36" x 36" West. Pit Type Electric
10" x 12" x 24" LINDBERG, 2500° F. Hyd
36 x 96, 48 x 120, 48 x 144 gas fired
Large Stock Gas Fired Box Heat Treating Furnaces

• PIT TYPE ANNEALING
42 x 96, 42 x 120 recirculating gas fired

• GRINDERS
DOUBLE END
3 Hp HISEY WOLF 3/60/220
5 Hp U.S. Model 64, 3/60/220
7½ Hp U.S. Model 66, 3/60/440
15 Hp MARSCHKE 220 volt
25 Hp KLING 3" dia. shaft
SWING FRAME
10 Hp SAFETY 24" x 3" wheel
15 Hp MARSCHKE 3/60/220-440
15 Hp MUMMERT-DIXON

• LADLES
BOTTOM POUR
MODERN 49" x 49"
MODERN Crane Type, 60" H x 60" top
LIP POUR
WHITING 28" x 28" top dia. geared
WHITING 29" x 29" top dia. geared
CYLINDRICAL
WHITING, 26" L x 25" dia, 1100# iron
WHITING, 19" L x 22" dia, 600# iron
WHITING, 38" L x 28" dia, 2200# iron

• MATERIALS HANDLING
BYERS Mobile Crane, BUDA Engine, 50' Boom, 5 ton w/magnet & bucket
HOUGH PAYLOADER, Model HA, 1000# cap., hyd. lift
5 Ton Crane 50'-AC w/300' "A" Frame Runway, M.G. Set-Magnet-Bucket
30 Ton Crane 83' Span, L&H, Very Late

• OVENS
ALLIS CHALMERS 20 KW, Model 750, dielectric
COLEMAN, Gas, 2 Comp. and 5 drawers, O.D. 22' x 12' x 10'
GIRDLER Thermex Dielectric Core Oven, 15KW w/36" W mesh belt
THERMONIC Dielectric Core Oven, 18 KW, w/40" wide mesh belt

• PRESSES
40 Ton FERRACUTE Sprue Cutter 1⅛" stroke
125 ton R.D. WOOD Down acting, 9" stroke
NIAGARA No. 82 Punch Press

• SAND CONDITIONING
B&P Nite-Gang
B&P Screenarator, Model "M"
LINK-BELT Revivifier
ROYER NB-2, 7-10 tons/hr., ¾ Hp.
ROYER PREPARATOR, Comb., Model NDC, 25 ton/hr scrap removal 5' x 5' hopper
ROYER, NDP, 15-25 tons/hr, 2 Hp
ROYER, "NRP," 40-60 tons/hr, 5 Hp.

• SAND SLINGERS
B&P Stationary, Single Speed
B&P Tractor Type 19" Head
B&P Motive Jr., 2 speed, 19" head, 5" tip

• TESTING MACHINES
3000 Kg Gogan Brinell Testers
Detroit "Brinell" Direct Reading Hardness Tester—Model DH-1

OSBORN * BLOW - SQUEEZE - STRIP - TANDEM MOLDING UNIT & TROLLEY SYSTEM
LIKE NEW
Completely Automatic. To be sold in Tandem or Indiv. at a Fraction of Cost. Squeeze Cyl 21" Dia. Max. Sq. Piston Stroke 12⅞" Comp w/100 sets 20" x 24" Flasks Model 360-1.
PHONE-WIRE-WRITE FOR COMPLETE DETAILS.

• MOLDING MACHINES
JOLT ROLLOVER PATTERN DRAW
DAVENPORT #408A, 40" x 60" table,
HERMAN 10,000# 48" x 109" table
HERMAN 6000#, 42" x 78"
HERMAN 7500#, 40" x 50" table
HERMAN 3000#, 30" x 66" table
HERMAN 3000#, 32" x 70", 15" cyl. series charging conveyor type
HERMAN 1500#, 30" x 48" table
HERMAN 750#, 20" x 24" table
INTERNATIONAL 27" x 16", Type F, 22" x 64" table
INTERNATIONAL 43" x 16", type F, 42" x 72" table
INTERNATIONAL 31" x 16", Type F, 28" x 78" table
INTERNATIONAL 30" x 12", Type G, 28" x 35" table
INTERNATIONAL 13" x 17" table
J & I #610, 24" x 30" table
OSBORN #602, 36" x 26", 900#
OSBORN #444, 28" x 39" table, 1000#, port.
OSBORN #405, 3000#, flask 64" x 57"
OSBORN #243, 31" x 42"
TABOR 40" x 50" table, 3000# capacity
TABOR 22" x 42" pattern draw shockless, portable 600#
TABOR 20" x 30" w/air clamp 1000#
TABOR 14" x 16" Rockover 150#
PLAIN JOLT
INTERNATIONAL, 2' x 4' Table, 12" cyl.
TABOR 3' x 4' table
JOLT PIN LIFT
HERMAN #1317, 22" x 30" table
OSBORN #558, 21" x 24" table
OSBORN #540, 29" x 38" table
SPO #3058, 23" x 27" table
SPO #305, 750 lb. 20" x 27" table
TABOR 20" x 24" table, 600#
JOLT SQUEEZE PIN LIFT
INTERNATIONAL PKL, 20" x 28" table, 14" sq. 5½" draw
INTERNATIONAL PKL, 18" x 24" table, 12" sq., 5½" draw, stat.
MILWAUKEE #163, 15" x 24" table, 11" sq., 1500#
NICHOLLS 18-44, 6¼" draw
OSBORN #1024, 1800#, 10¼" draw
OSBORN #716 PJ, 22" x 34" table 16" sq., 8" draw
OSBORN, #712J, #712PJ, 18" x 28" table, 12" sq., 6" draw, stat. & port.
SPO #2114P, 21" x 27" table, 600#
SPO #2116, 21" x 27" table, 11" sq.
JOLT SQUEEZERS
INTERNATIONAL #12 LJS, 16" x 20"
OSBORN #276-J & PJ, 17" x 26" table
OSBORN #275J, 16" x 20" table, 400#
SPO 113PJ, 18⅛" x 26" table
SPO #110J, 17" x 20" table, 400#
TABOR Squeeze-in Head, 16" x 19" table
TABOR Yoke Type, 18" x 26" table

• MULLERS AND MIXERS
B&P No. 3½ Mulbaro, 3½ cu. ft.
B&P #30 Speedmuller w/skip, 3 cu. ft
B&P #40 Speedmuller w/skip, 5 cu. ft.
B&P Conventional, SIMPSON type, 87⅛" Dia., arranged for cooling
B&P #70 Speedmuller, 15 cu. ft. w/cooling
CLEARFIELD #920, 9' dia., 30 cu. ft.
SIMPSON #1, U.D., 4' dia., 4 cu. ft.
SIMPSON #1, Sep. Dr., 4' dia., 4 cu. ft.
SIMPSON #1½, Sep. Dr., 4'6" dia., 6 cu. ft.
SIMPSON #2, U.D., 6' dia., 14 cu. ft.
SIMPSON #3, 8' Dia. Sep. Dr. or U.D. 30 cu. ft.
WHIRLMIX 31" dia., 200 to 300 lb. sand

• SHAKEOUTS
2' x 10' HEWITT-ROBINS
3' x 10' SIMPLICITY
4' x 5' SIMPLICITY
4' x 6' SIMPLICITY
4' x 8' SIMPLICITY
5' x 6' HEWITT-ROBINS

• TRANSFORMERS (Furnace)
100 KVA KUHLMAN 13,200, 1/60
250 KVA WESTINGHOUSE 6600, 3/60
300 KVA WAGNER 4000, 1/60
500 KVA KUHLMAN 13,200, 1/60
800 KVA PENNA, 23,000, 3/60
1000 KVA WESTINGHOUSE 23,000, 3/60
2000 KVA WESTINGHOUSE 13,200, 3/60
5000 KVA WESTINGHOUSE 2300, 3/60

• MISCELLANEOUS
AMERICAN "P" Rod Straightener, ⅜" to 1¼"
BLASTCRETE Model PM-1 Cupola Gun
CLIMAX Model 2-A Wire Straightener
CRESCENT Band Saw, 32" wheels
FLASKS, CORE PLATES, All Sizes
MOULDER'S Hoppers, Various Sizes
SLY Rd. Tumb. Bbl. 66" x 32", 48" x 36" 69" x 39"

* Your *DEPENDABLE* Foundry Equipment Dealer

For More Information Circle 873, Page 39

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FOUNDRY ENGINEERING SERVICE

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HAMLIN-NAGEL, INCORPORATED

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SANDSLINGERS

B & P Tractor type, 6' jib, 4' ram arm, 19" head
B & P Stationary Type 6' Jib, 4' Ram Arm, 19" head, 25 HP

SHELL SAND MULLERS

2—B & P No. 3½ Mulbarrows with cycle controls and timers.
2—B & P No. 30 Speedmullers with skip hoists arranged for shell sand.

JOLT SQUEEZERS

Osborn 275J
Osborn 276, 13" Portable and Stationary
International LJS 10"—12"
International PJS 16"
Tabor Top Squeeze 10"
SPO 110J
Champion 10"
Milwaukee 104-5—10"—12"
SPO 2136

JOLT SQUEEZE PIN LIFT

Milwaukee 126 Portable 21 x 27 Table 8" Draw
Milwaukee 145 24 x 30 Table 8" Draw
Milwaukee 195, 28 x 39 table, 10" draw
Osborn 712 18 x 28 Table 6" Draw

2—Milwaukee 195, 28 x 39 table, 10" draw

JOLT ROLLOVER DRAW

International "G" 30 x 12
International "F" 45 x 72 x 16" Draw
J&J 612, 25 x 30 x 8" Draw
J&J 815, 30 x 40 x15" Draw
J&J 918, 44 x 54 table, 18" Draw
J&J 1020B, 50 x 60 table, 20" draw
SPO 506, 24 x 25 table, 10" draw
SPO 508, 28 x 30 x 9" Draw
Tabor 30 x 50 x 12" Draw Shockless

JOLT PIN LIFT

Davenport 34A, 36 x 46 x 12" Draw
J&J 1216B, 36 x 54 x 16" Draw
J&J 688, 24 x 30 x 6" Draw
Milwaukee 1536, 32 x 38 x 10" Draw
Osborn 558 20" x 24" x 5" Draw
SPO 3070

JOLT SQUEEZE ROLLOVER DRAW

SPO 9546, 30 x 40 Flask 11" Draw
SPO 920, 32 x 44 Flask 11" Draw
Osborn 332, 26 x 36 Flask 9" Draw

PLAIN JOLTERS

J&J 72 x 72
Tabor 48" x 60"

SAND MULLERS

SHELL SAND MULLERS

B & P No. 3½ Mulbarrows with cycle controls and timers
B & P No. 30 Speedmullers with skip hoists arranged for shell sand

Simpson Lab Muller, 24"
Simpson 1½ UD w/or w/o skip hoist
Simpson No. 1, Style "H"
Simpson #2 w/skip (open gear)
Simpson #2 UD w/aerator and skip hoist
Simpson No. 3, Style C, enclosed gear with skip hoist
Simpson #3 UD auto-cycle, dust hood, etc.

B&P No. 3½ Mulbaro
B&P No. 30 with skip hoist
B&P #60, w or w/o Multromatic
Clearfield 610
B&P 50 with skip hoist, cooling and water meter
Simpson No. 3, Style C, enclosed gear with skip hoist.

SAND CONDITIONERS

B&P Screenerators, M. L.
B&P Junior Night Gang
Royer NDP, NC2, JR, and NC4
American Sand Cutter, various sizes
Newaygo Handy Sandy H87GT

SHAKEOUTS

Simplicity 6 x 8
Allis Chalmers 8 x 10
Simplicity 4 x 6
Simplicity 4 x 8

CORE BLOWERS

Redford No. 1 and No. 2
Champion, CB15
Chicopee Core Chief shell core blowers
Demmler No. 55, 1, 2K, 3E
Hansberg Shooter
Demmler 103EO w/feeder skip hoist, semi-auto cycle
Rose Vibra—Draws
Federal San Blo Pulsator, Model L40P1LPP
B&P Flexiblo, Model No. CB-10-DH w/ Universal Blo Plate

CORE OVENS

Tower oven, various sizes
Batch type, core & mold drying, various sizes
Porbeck 16-2B double and single end five drawer
Foundry Equipment, single end, 5 drawer
Porbeck C3C Double End and Single End, Oil Fired

CUPOLAS

Whiting No. 7 with Whiting No. 7 Inclined Skip Dump Charger, Spencer Turbo Centrifugal Blower 75 HP, Foxboro Air Weight Controller, Syntron Alloy Feeder, all new 1957, excellent.

Whiting Nos. 0, 4, 7, 9, 10
Cupola Blowers, various sizes
Modern swivel charger
Hauck cupola lighter
Series 1000 Bondactor
Cupoliner Model 1500

LADLES AND POURING DEVICES

Modern, Whiting, all sizes plus mixing ladle, electric tilt, cylindrical and tea pot lip pour

NON FERROUS FURNACES

#60 to #250 Crucible & Iron Pot Furnaces, stationary and tilt
Lindberg Fisher Electric Induction
Reda 1000# power tilt type reverberatory
Stroman 1200# Economelt gas fired
Stroman 1600#/hr. reverberatory, 1 station double chamber reverberatory
6000# Fisher Simplex reverberatory complete, gas fired
Lindberg Fisher NMP nose pour, 1000# capacity, gas fired

CLEANING EQUIPMENT

48 x 72 American Wheelabrator with skip and dust collector

48 x 48 American Wheelabrator w/skip hoist
42 x 48 American Wheelabrator
36 x 42 American Wheelabrator with skip & dust collector
27 x 36 American Wheelabrator with skip & dust collector
20 x 20 Air Blast Sly Barrel
36 x 72 Sly Tumbling Barrel, gearmotor drive
American 66" swing table
Pangborn LG 14, 6' table blast

GRINDERS

Marschke 2 x 24
U. S. No. 65, variable speed 24"
Gardner 54" surface grinder
Mummert-Dixon Swing 15 HP 3 x 24"
Gardner 36" opposed wheel surface grinder

AIR COMPRESSORS

100 HP XRB Ingersoll-Rand 2 stage, horizontal
175 HP XRE 2 stage, synchronous motor
30 HP Ingersoll-Rand horizontal
Gardner-Denver 15 HP, water cooled

AIR HOISTS

Ingersoll-Rand 700#, 1000#, 2000#, 4000# and 10,000#
Curtis Air Cylinder Hoists

ELECTRIC HOISTS

P & H 500#, 1000#
Comet 500#
Cleveland 1000#
Yale 1000#, 6000#
Budgit 1000#

MATERIAL HANDLING EQUIPMENT

Hough Payloaders HA Models
Michigan 12B Front End Loader
Hyster Forklift 2000#
Clark forklift, 6000 lb.
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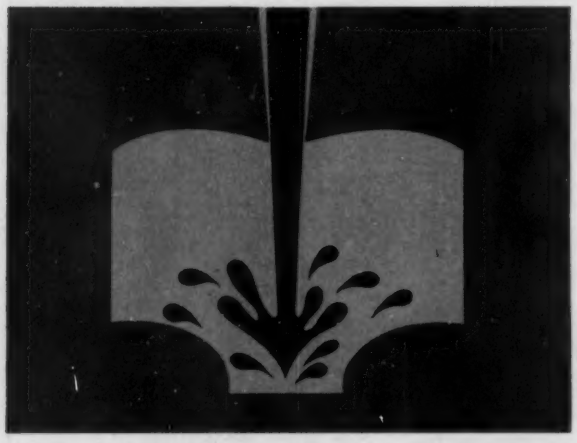

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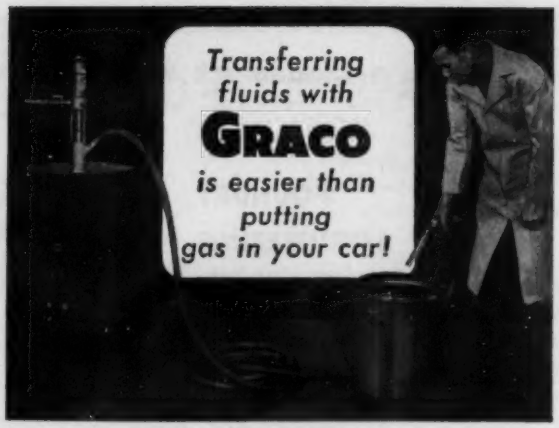

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Advertising Index

Abrasive Products, Inc., Atlantic Abrasive Corporation Division 223
Acme Foundry Co. 177
Acme Resin Corporation 209
Ajax Magnethermic Corporation 95
Alabama By-Products Corporation 195
Allis-Chalmers Manufacturing Co. 110, 111
American Bridge Division, United States Steel Corporation 178, 179
American Optical Co., Safety Products Division 181
American Refractories & Crucible Corporation 190
American Smelting and Refining Co., Federated Metals Division 47, 183
Archer-Daniels-Midland Co., Federal Foundry Supply Division 122, 123
Asbestos Textile Division, Raybestos-Manhattan, Inc. 56
Atlantic Abrasive Corporation, A Division of Abrasive Products, Inc. 223

Babcock & Wilcox Co., The, Refractories Division 6, 7
Baker Perkins, Inc., Foundry Machinery Division 127
Baroid Chemicals, Inc. 30, 31
Bay State Abrasive Products Co. 34, 35
Beardsley & Piper, Division of Pettibone Mulliken Corporation 24, 25, 168, 169
Bellows-Valvair, Division of International Basic Economy Corporation 16
Berkshire Chemicals, Inc. 242
British Cast Iron Research Association, The 177
Brown Boveri Corporation 200

C & S Products Co., Inc. 208
Campbell-Hausfeld Co., The 229
Carborundum Co., Bonded Abrasives Division 100
Carman, Edwin S., Inc. 224
Carpenter Brothers, Inc. 194
Cedar Heights Clay Co. 36
Centrifugal Casting Machine Co. 226
Clearfield Machine Co. 150
Cleveland Flux Co., The 173
Cleveland Metal Abrasive Co. 196
Cleveland Tramrail Division, The Cleveland Crane & Engineering Co. 52
Corn Products Co., Industrial Division 57

DeBardeleben Coal Corporation 226
Delta Oil Products Corporation 147
Demmler Manufacturing Co. 128
Desmond-Stephan Mfg. Co. 172
Despatch Oven Co. 223
Detroit Mold Engineering Co. 139
Detroit Testing Machine Co. 170
Diamond Alkali Co. 225, 227
Dietert, Harry W., Co. 41
Dow Corning Corporation 215
Dratt Manufacturing Corporation, Materials Handling Division 99
Durez Plastics Division, Hooker Chemical Corporation 216, 217

Eriez Manufacturing Co. 159

Funner Manufacturing Co., The 144, 145
Federal Foundry Supply Division, Archer-Daniels-Midland Co. 122, 123
Federated Metals Division, American Smelting and Refining Co. 47, 183
Ferro Corporation, Louthan Manufacturing Co., Division 172
Fly Ash Arrestor Corporation 162
Foseco, Inc. 12
Foundry Educational Foundation 189
Foundry Equipment Co., The 154
Foxboro Co., The 49
Fremont Flask Co., The 97

General Dynamics Corporation, Liquid Carbonic Division 8
Goodrich, B. F., Chemical Co., A Division of The B. F. Goodrich Co. 2
Goodrich, B. F., Co., B. F. Goodrich Chemical Co., Division 2
Gray Co., Inc. 240
Great Lakes Carbon Corporation 58
Great Western Mfg. Co. 226

Hanna Furnace Corporation, The, A Division of National Steel Corporation 142, 143
Hannifin Co., A Division of Parker-Hannifin Corporation 185
Harbison-Walker Refractories Co. 115, 116
Hartley Controls Corporation 117
Hercules Powder Co., Inc. 53
Hines Flask Co., The 11
Hooker Chemical Corporation, Durez Plastics Division 216, 217
Hough, Frank G., Co., The 136
Humble Oil & Refining Co. 133

Imperial Belting Co. 192
Inductotherm Corporation 22
International Basic Economy Corporation, Bellows-Valvair Division 16
International Foundry Supply Co. 188
International Minerals & Chemical Corporation, Industrial Minerals Division 125, 199
International Nickel Co., Inc., The 1

Jeffrey Manufacturing Co., The 46
Jebbins, William F., Inc. 223
Johns-Manville Corporation 193
Johnston Manufacturing Co. 167
Joy Manufacturing Co. 55

Kokuk Electro-Metals Co., Division of Vanadium Corporation of America 156
Knight, Lester B., & Associates, Inc. 42
Koppers Co., Inc. 207
Kozma, J. A., Co. 194

Latella, D. C., & Associates, Inc. 228
Liquid Carbonic, Division of General Dynamics Corporation 8

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For More Information Circle 715, Page 39

Advertising Index

Logan Co. 48
Louthan Manufacturing Co., A Division of Ferro Corporation 172

Macklin Co. 219
Magnet Cove Barium Corporation 186
Manhattan Rubber Division, Raybestos-Manhattan, Inc. 152
Marshall, L. H., Co. 228
Master Power Corporation 9
Mayer, Carl, Corporation, The 106
Metal Blast, Inc. 191
Metal & Thermit Corporation 240
Michigan Oven Co. 224
Minnesota Mining and Manufacturing Co. 163
Modern Equipment Co. 244
Mount Vernon Mills, Inc. 13

National Acme Co., The, Shalco Division ... 157
National Chemical & Plastics Co., The 224
National Engineering Co. 14, 15
National Steel Corporation, The Hanna Furnace Corporation Division 142, 143
New York & New Jersey Lubricant Co. 218
Newaygo Engineering Co. 43
Nicholls, Wm. H., Co., Inc. 204
Nomad Equipment Corporation 32
Northeast Metals Co. 240
Northwest Olivine Co. 10
Norton Co. 33, 221
Norton Co., Refractories Division 103

Ohio Crankshaft Co., The 135
Olin Aluminum ..... Back Cover
Osborn Manufacturing Co., The 108, 109

Pangborn Corporation 171, 184
Parker-Hannifin Corporation, Hannifin Co., Division 185
Peabody Engineering Corporation 220
Pekay Machine & Engineering Co., Inc. 160, 161
Penn Iron Works, Inc. 227
Pennsylvania Glass Sand Corporation, Industrial Silica Division 45
Pettibone Mulliken Corporation, Beardsley & Piper Division 24, 25, 168, 169
Philadelphia Quartz Co. 188
Pickands Mather & Co. 164
Picker X-Ray Corporation 242
Pittsburgh Coke & Chemical Co., Coke & Iron Division 137
Pittsburgh Metals Purifying Co., A Division of Treesdale Laboratories, Inc. 211

Raybestos-Manhattan, Inc., Asbestos Textile Division 56
Raybestos-Manhattan, Inc., Manhattan Rubber Division 152
Reda Pump Co., Furnace Division 210
Redford Iron & Equipment Co. 166
Republic Steel Corporation 28, 29
Reynolds Metals Co. 130, 131
Royer Foundry & Machine Co. 105
Rudow Manufacturing Co. 227

Scientific Cast Products Corporation, The 225
Security Alloys Co., Inc., Foundry Division 5
Shalco Division, The National Acme Co. 157
Shepard Niles Crane and Hoist Corporation 146
Sidley, R. W., Inc. 226
Simonds Abrasive Co., Division of Simonds Saw and Steel Co. 44
Simonds Saw and Steel Co., Simonds Abrasive Co., Division 44
Simplicity Engineering Co. 119
Smillie, C. M., & Co. 228
Smith Oil & Refining Co., Industrial Oils Division 203
Spencer Turbine Co., The 206
Spo, Inc. 174
Spraying Systems Co. 225
States Engineering Corporation 204
Stevens, Frederic B., Inc. .... Inside Back Cover
Swindell-Dressler Corporation 140

Taccone Corporation 197
Tamms Industries Co. 170
Taylor, Chas., Sons Co., The 54
Therm Ice Corporation 243
Treesdale Laboratories, Inc., Pittsburgh Metals Purifying Co., Division 211
Triax Co., The 27
Turner Halsey Co. 13

Union Carbide Corporation, Union Carbide Metals Co., Division .... Inside Front Cover
Union Carbide Metals Co., Division of Union Carbide Corporation .... Inside Front Cover
United States Graphite Co., The, Division of The Wickes Corporation 113
United States Rubber, Mechanical Goods Division 50, 51
United States Steel Corporation, American Bridge Division 178, 179
United States Steel Corporation, Subsidiaries 178, 179
United States Steel Export Co. 178, 179
Universal Clay Products Co. 126

Vanadium Corporation of America 205
Vanadium Corporation of America, Keokuk Electro-Metals Co., Division 156

Wellman Engineering Co., The, Williams Bucket Division 224
Wheelabrator Corporation 149, 151, 153
Whirl-Air-Flow Corporation 176
Whitehead Brothers Co. 21
Whiting Corporation 180
Wickes Corporation, The, The United States Graphite Co., Division 113
Williams Bucket Division, The Wellman Engineering Co. 224
Wirebound Box Manufacturers Association, Inc. 118
Woodward Iron Co. 212

Classified Advertising 229, 230, 231, 232, 233, 234, 235, 236, 237, 238, 239

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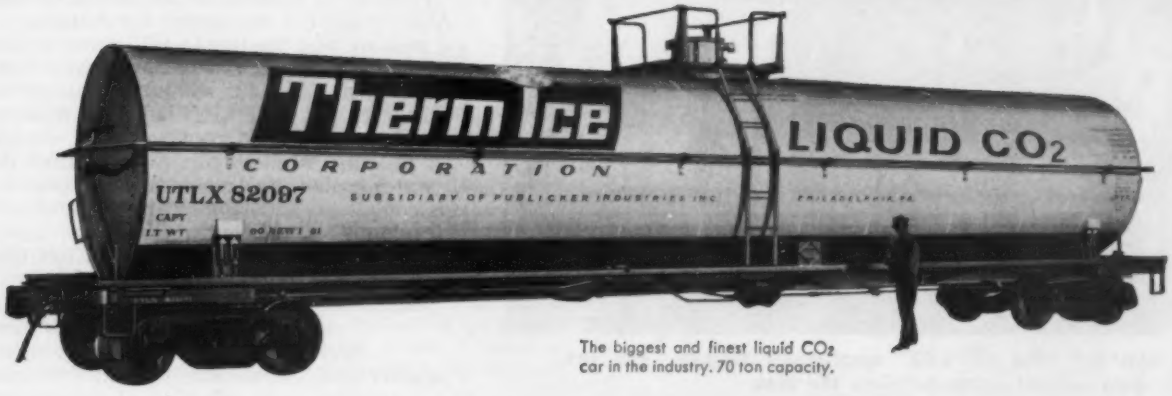

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For More Information Circle 716, Page 39

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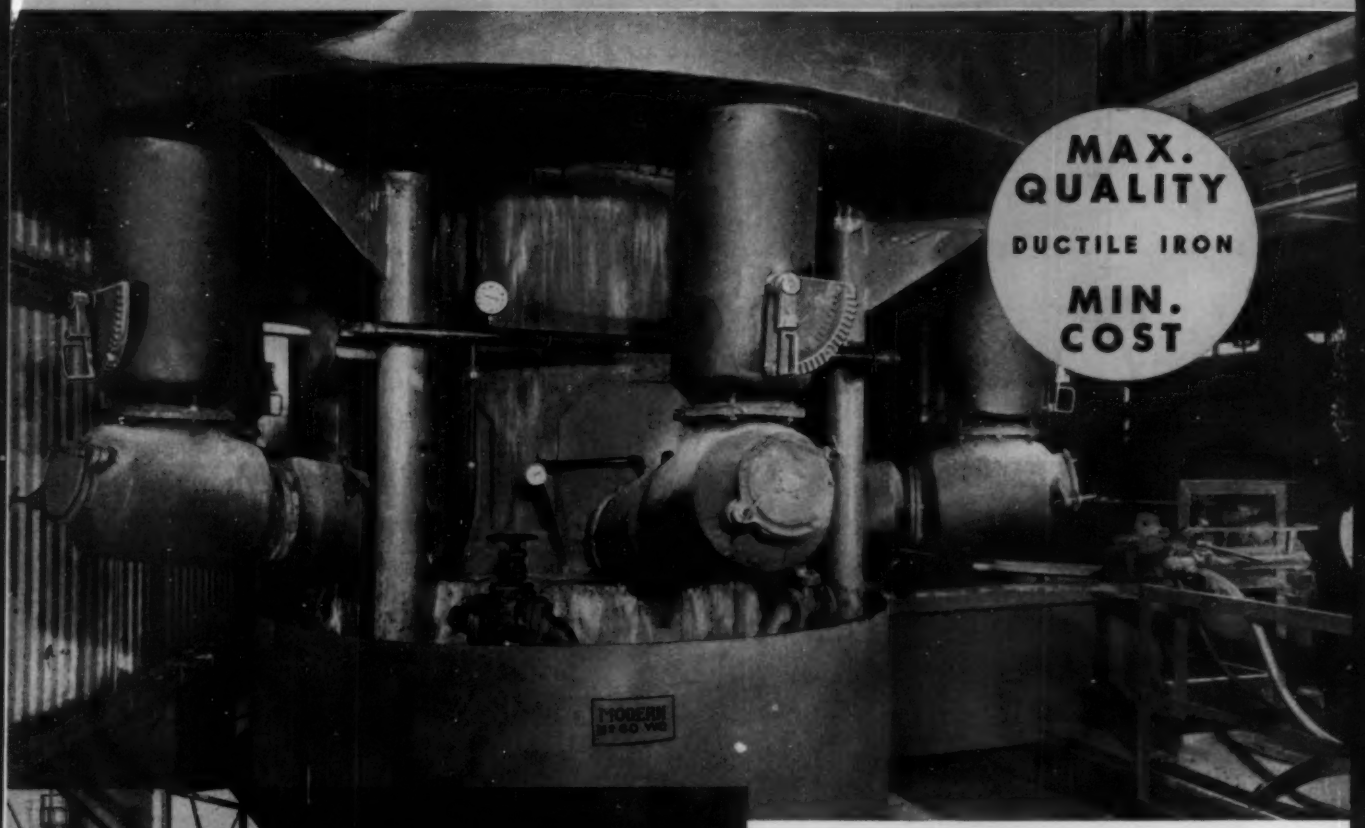

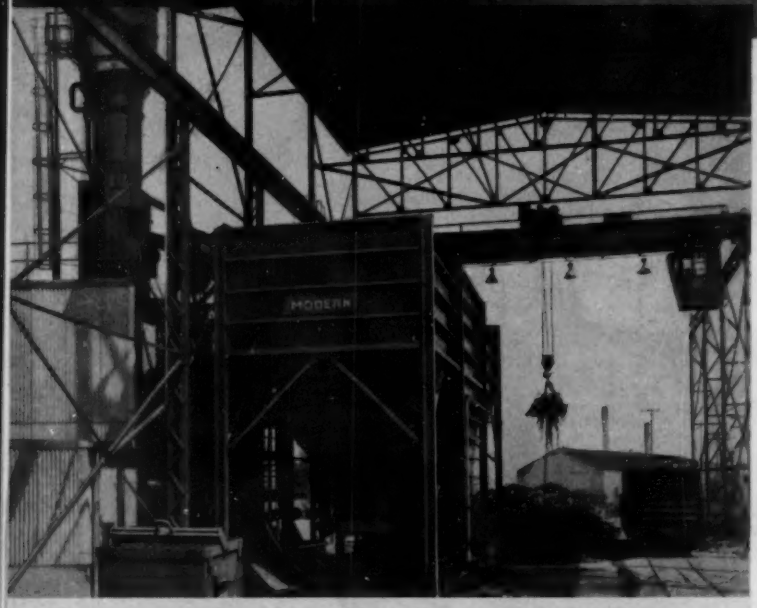

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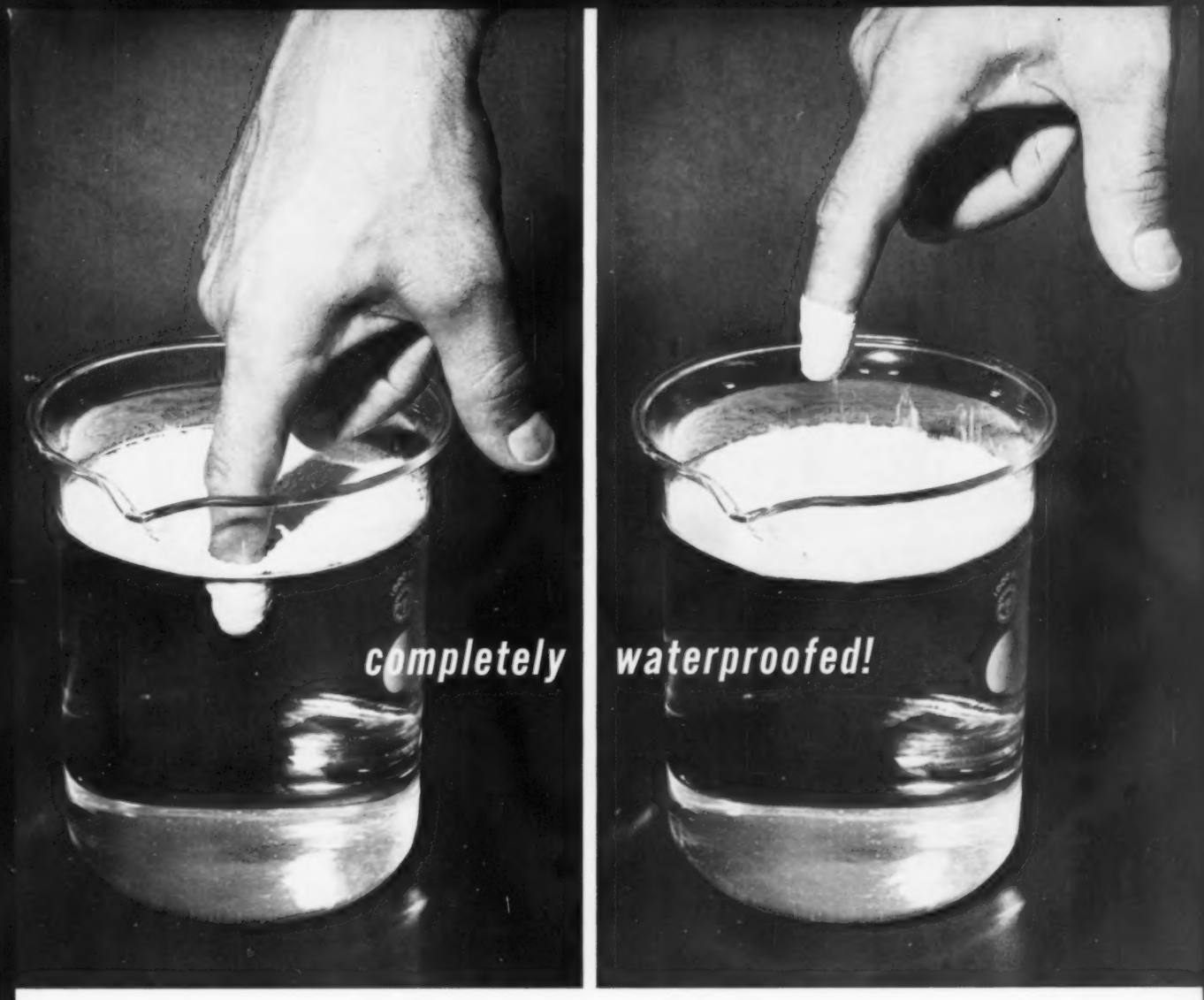
For More Information Circle 717, Page 39



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